FISHERIES REPORT
REPORT NO. 09-03
WARMWATER STREAM FISHERIES REPORT
REGION IV
2008

Prepared by

Bart D. Carter
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Cover: Rick Bivens keeps an eye out for fish during an electrofishing survey of Little River.

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INTRODUCTION

The fish fauna of Tennessee is the most diverse in the United States, with approximately 307 species of native fish and about 30 to 33 introduced species (Etnier and Starnes 1993). Region IV has 7,837 km of streams that total approximately 5,711 ha in 21 east Tennessee counties. There are approximately 1,287 km classified as coldwater streams. Streams in Region IV, except for a few in Anderson, Campbell, and Claiborne counties (Cumberland River System streams) are in the Ridge and Valley and Blue Ridge physiographic provinces of the upper Tennessee River drainage basin. The main river systems in the region are the Clinch, Powell, Little Tennessee, mainstream Tennessee River, French Broad, Nolichucky, and Holston.

Streams and rivers across the state are of considerable value as they provide a variety of recreational opportunities. These include fishing, canoeing, swimming, and other riverine activities that are unmatched by other aquatic environments. Streams and rivers are also utilized as water sources both commercially and domestically. The management and protection of this resource is recognized by Tennessee Wildlife Resources Agency (TWRA) and has been put forth in the Strategic Plan (TWRA 2006) as a primary goal.

This is the twenty-first annual report on stream fishery data collection in TWRA's Region IV. The main purpose of this project is to collect baseline information on game and non-game fish and macroinvertebrate populations in the region. This baseline data is necessary to update and expand our Tennessee Aquatic Database System (TADS) and aid in the management of fisheries resources in the region.

Efforts to survey the region’s streams have led to many cooperative efforts with other state and federal agencies. These have included the Tennessee Department of Environment and Conservation (TDEC), Tennessee Valley Authority (TVA), U.S. Forest Service (USFS), Oak Ridge National Laboratory (ORNL), and the National Park Service (NPS).

The information gathered for this project is presented in this report as river and stream accounts. These accounts include an introduction describing the general characteristics of the survey site, a study area and methods section summarizing site location and sampling procedures, a results section outlining the findings of the survey(s), and a discussion section, which allows us to summarize our field observations and make management recommendations.

METHODS

The streams to be sampled and the methods required are outlined in TWRA field request No. 04-08. Four rivers were sampled and are included in this report. Stream surveys were conducted from April to July 2008. A total of thirty (IBI, CPUE) fish samples and four benthic samples were collected.

SAMPLE SITE SELECTION

Index of Biotic Integrity (IBI) sample sites were selected that would give the broadest picture of impacts to the watershed. We typically located our sample site in close proximity to the mouth of a stream to maximize resident species collection. However, we positioned survey sites far enough upstream to decrease the probability of collecting transient species. Large river sampling sites were selected based on historical sampling locations and available access points. Typically we selected sample areas in these rivers that represented the best available habitat for any given reach being surveyed. Sampling locations were delineated in the field utilizing hand held Geographical Positioning Units (GPS) and then digitally re-created using a commercially available software package.

WATERSHED ANALYSIS

Watershed size and/or stream order has historically been used to create relationships for determining maximum expected species richness for IBI analysis. This has been accomplished by plotting species richness for a number of sites against watershed areas and/or stream orders (Fausch et al. 1984). We chose to use watershed area (kilometer^2) to develop our relationships as this variable has been shown to be a more reliable metric for predicting maximum species richness. Watershed areas (the area upstream of the survey site) were determined from USGS 1:24,000 scale maps.

FISH COLLECTIONS

Fish data were collected by employing an Index of Biological Integrity (Karr et al. 1986). Fish were collected with standard electrofishing (backpack) and seining techniques. A 5 x 1.3 meter seine was used to make hauls in shallow pool and run areas. Riffle and deeper run habitats were sampled with a seine in conjunction with a backpack electrofishing unit (100-600 VAC). An area approximately the length of the seine^2 (i.e., 5 meters x 5 meters) was electrofished in a downstream direction. A person with a dipnet assisted the person electrofishing in collecting those fish, which did not freely drift into the seine. Timed (5-min duration) backpack electrofishing runs were used to sample shoreline habitats. In both cases (seining or shocking) an estimate of area (meter^2) covered on each pass was calculated. Fish collections were made in all habitat types within the selected survey reach. Collections were made

repeatedly for each habitat type until no new species was collected for three consecutive samples for each habitat type. All fish collected from each sample were enumerated and in the case of game fish, lengths obtained. Anomalies (e.g., parasites, deformities, eroded fins, lesions, or tumors) were noted along with occurrences of hybridization. After processing, the captured fish were either held in captivity or released into the stream where they could not be recaptured. In larger rivers, a boat was used in conjunction with the backpack samples to effectively sample deep pool habitat. Timed (10-min duration) runs were used until all habitat types had been depleted.

Catch-per-unit-effort samples (CPUE) were conducted in three rivers during 2008. Timed boat electrofishing runs were made in pool and shallower habitat where navigable. Efforts were made to sample the highest quality habitat in each sample site and include representation of all habitat types typical to the reaches surveyed. Total electrofishing time was calculated and used to determine our catch-effort estimates (fish/hour).

Generally, fish were identified in the field and released. Problematic specimens were preserved in 10% formalin and later identified in the lab or taken to Dr. David A. Etnier at the University of Tennessee Knoxville (UTK) for identification. Most of the preserved fish collected in the 2008 samples will be catalogued into our reference collection or deposited in the University of Tennessee Research Collection of Fishes. Common and scientific names of fishes used in this report are after Nelson et al. (2004), Powers and Mayden (2007) and Etnier and Starnes (1993).

BENTHIC COLLECTIONS

Qualitative benthic samples were collected from each IBI fish sample site (4 total). These were taken with aquatic insect nets, by rock turning, and by selected pickings from as many types of habitat as possible within the sample area. Taxa richness and relative abundance are the primary considerations of this type of sampling. Taxa richness reflects the health of the benthic community and biological impairment is reflected in the absence of pollution sensitive taxa such as Ephemeroptera, Plecoptera, and Trichoptera (EPT).

Large particles and debris were picked from the samples and discarded in the field. The remaining sample was preserved in 70% ethanol and later sorted in the laboratory. Organisms were enumerated and attempts were made to identify specimens to species level when possible. Many were identified to genus, and most were at least identified to family. Dr. David A. Etnier (UTK) examined problematic specimens and either made the determination or confirmed our identifications. Comparisons with identified specimens in our aquatic invertebrate collection were also useful in making determinations. For the most part, nomenclature of aquatic insects used in this report follows Brigham et al. (1982) and Louton (1982). Names of stoneflies (Plecoptera) are after Stewart and Stark (1988) and caddisflies are after Etnier et al. (1998). Benthic results are presented in tabular form with each stream account.

WATER QUALITY MEASUREMENTS

Basic water quality data were taken at most sites in conjunction with the fishery and benthic samples. The samples included temperature, pH, and conductivity. Data were taken from midstream and mid-depth at each site, using a YSI model 33 S-C-T meter. Scientific Products™ pH indicator strips were used to measure pH. Stream velocities were measured with a Marsh-McBirney Model 201D current meter. The Robins-Crawford "rapid crude" technique (as described by Orth 1983) was used to estimate flows. Water quality parameters were recorded and are included with each stream account.

HABITAT QUALITY ANALYSIS

Beginning in 2004, the stream survey unit introduced an experimental habitat assessment form that built on the existing method by incorporating biological impairment and metric modifications to the standardized form (Smith et al. 2002). The major advantages of this evaluation procedure include more concise metrics and categories that identify the stream or river based on size, gradient, temperature, ecoregion and alterations of flow based on groundwater or hydroelectric influences.

The other issue we wanted to address with this new evaluation was the development of our own biotic index for benthic macroinvertebrates. By assigning an overall value to the water quality, habitat, and biological impairment of a given reach of stream we can begin to assign tolerance values to associated benthic insect species collected during the survey. This will ultimately allow us to develop a more accurate biotic index for benthic macroinvertebrates for the Ridge and Valley and Blue Ridge Ecoregions of east Tennessee. The illustrations below depict the layout of the experimental form including the 14 habitat/water quality metrics, the biotic index adjustment, ecoregion classification, and stream type.

We feel that this form allows use to be more precise in our evaluation of the stream habitat quality and gives us a more defined evaluation pertaining to stream morphology and location. We will continue to complete both habitat evaluations for each stream survey for the next couple of field seasons in order to fully evaluate the new form.

Experimental Stream Habitat Assessment Form

STREAM QUALITY ASSESSMENT FORM

FORM:SQA-09-2004

Tennessee Wildlife Resources Agency Stream Survey Unit

STREAM:_____ DATE:_____

INVESTIGATOR:_____ SITE CODE:_____

LAT/LONG:_____ ELEVATION:_____

Rate Each Of The Following 14 Metrics:

0(EXCELLENT) 1(GOOD) 2(FAIR) 3(POOR) 4(VERY POOR)

note: 0 = pristine condition and 4 = worst condition

SCORE

1 SILTATION ☐

(fine particles that blanket [smother] the substrate)

2 SUBSTRATE EMBEDDEDNESS ☐

(interstitial spaces between gravel, cobble and boulder have become filled with fine deposits such as sand making the underside habitat unsuitable to aquatic life)

3 BED-LOAD MOVEMENT ☐

(condition pertaining to excessive bed load movement, and frequent formation and destruction of sand and gravel bars)

4 STATE OF SMALL RIPARIAN VEGETATION ☐

(grasses, shrubs, etc. that stabilize the soil surface and serve as runoff filters)

5 STATE OF LARGE RIPARIAN VEGETATION ☐

(canopy trees that provide long-term bank stability and shade)

6 BANK STABILITY ☐

(signs of bank erosion)

7 PHYSICAL DAMAGE TO STREAM HABITAT BY DOMESTIC LIVESTOCK ☐

(obvious signs of damage within riparian zone and instream habitat from livestock traffic)

8 ALTERATIONS OF NATURAL PHYSICAL CHARACTERS OF STREAMBED ☐

(channelization, gravel dredging, channel relocation, bridges, culverts, dams, fords etc.)

9 TURBIDITY ☐

(suspended solids "muddy or cloudy")

10 POINT SOURCE POLLUTION ☐

(FACTORY, MINING SOURCE, etc.)

(pipes or ditches conveying contaminated effluent adversely affecting water quality), chemical odor and/or unusual water or substrate coloration. (reddish algae [organic] or iron oxide [inorganic] often associated with severe earth disturbance)

11 ENRICHMENT ☐

(agricultural livestock waste and/or crop fertilizers, poorly functioning municipal waste water treatment facility or residential septic systems often indicated by filamentous algae etc.)

12 ATYPICAL WATER QUALITY PARAMETERS (BASIC) ☐

(unusually high or low pH, conductivity, dissolved oxygen, or temperature)

13 ENVIRONMENTALLY HARMFUL TRASH ☐

(human refuse including oil filters, engines, batteries, tires, etc. that may be toxic to aquatic organisms)

14 ALTERED STREAM FLOW (CFS) ☐

(abnormal fluctuations in flow volume [e.g. hydroelectric dam regulation], or low flow due to water consumption for municipal water, bottled water, crop irrigation, or other water demands.)

TOTAL ☐

BIOTIC INDEX ADJUSTMENT (BIA) + ☐

(does one or more of the previous 14 metrics seriously inhibit aquatic life?)

0 (no biological impairment) **5** (only the most sensitive taxa impaired)

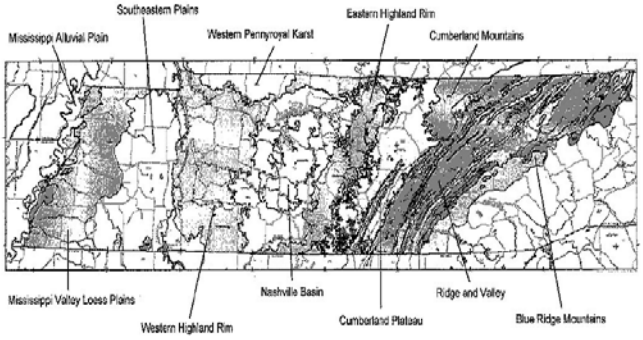
10 (somewhat diverse but most intolerant forms absent) **15** (low diversity—tolerant forms only)

20 (little or no aquatic life present)

STREAM ASSESSMENT VALUE = TOTAL + BIA → ☐

0 - 10 (EXCELLENT) 11 - 21 (GOOD) 22 - 32 (FAIR) 33 - 43 (POOR) ≥44 (VERY POOR)

INDICATE (CIRCLE) ECOREGION:



STREAM TYPE:	GRADIENT LOW <0.01	GRADIENT MOD 0.01-0.05	GRADIENT HIGH >0.05	TEMPERATURE COLD <20°C	TEMPERATURE COOL <25°C	TEMPERATURE WARM >25°C	Maximum Summer Temp
HEADWATER (0 - 2 METERS)	☐	☐	☐	☐	☐	☐	
SMALL CREEK (2.1 -11.0 METERS)	☐	☐	☐	☐	☐	☐	
LARGE CREEK (11.1 -21.0 METERS)	☐	☐	☐	☐	☐	☐	
SMALL RIVER 1 (21.1 - 111 METERS)	☐	☐	☐	☐	☐	☐	
SMALL RIVER 2 (111.1 - 201 METERS)	☐	☐	☐	☐	☐	☐	
MEDIUM RIVER (202 METERS - 502 METERS)	☐	☐	☐	☐	☐	☐	
LARGE RIVER (>503 METERS)	☐	☐	☐	☐	☐	☐	

CHECK IF STREAM IS:

A SPRING RUN (near source) ☐

A CREEK WITH SIGNIFICANT SPRING INFLUENCE ☐

A TAILWATER ☐

Ecoregion designations follow Griffith (USEPA) et al. Stream Type, and Gradient definitions generally follow Smith, R.K., P.L. Freeman, J.V. Higgins, K.S. Wheaton, T.W. FitzHugh, K.J. Ernstrom, A.A. Das. Priority Areas for Freshwater Conservation: A Biodiversity of the Southeastern United States. The Nature Conservancy. 2002.

DATA ANALYSIS

Twelve metrics described by Karr et al. (1986) were used to determine an IBI score for each stream surveyed. These metrics were designed to reflect fish community health from a variety of perspectives (Karr et al. 1986). Given that IBI metrics were developed for the midwestern United States, many state and federal agencies have modified the original twelve metrics to accommodate regional differences. Such modifications have been developed for Tennessee primarily through the efforts of TWRA (Bivens et al. 1995), TVA, and Tennessee Tech University. In developing our scoring criteria for the twelve metrics we reviewed pertinent literature [North American Atlas of Fishes (Lee et al. 1980), The Fishes of Tennessee (Etnier and Starnes 1993), various TWRA Annual Reports and unpublished data] to establish historical and more recent accounts of fishes expected to occur in the drainages we sampled. Scoring criteria for the twelve metrics were modified according to watershed size. Watersheds draining less than 13 kilometer^2 were assigned different scoring criteria than those draining greater areas. This was done to accommodate the inherent problems associated with small stream samples (e.g., lower catch rates and species richness). Young-of-the-year fish and non-native species were excluded from the IBI calculations. After calculating a final score, an integrity class was assigned to the stream reach based on that score. The classes used follow those described by Karr et al. (1986).

Karr et al. (1986) criteria Total IBI score (sum of the 12 metric ratings)	Integrity Class	Attributes
58-60	Excellent	Comparable to the best situations without human disturbance; all regionally expected species for the habitat and stream size, including the most intolerant forms, are present with a full array of size classes; balanced trophic structure.
48-52	Good	Species richness somewhat below expectation, especially due to the loss of the most intolerant forms; some species are present with less than optimal abundance or size distributions; trophic structure

		shows some signs of stress.
40-44	Fair	Signs of additional deterioration include loss of intolerant forms, fewer species, highly skewed trophic structure (e.g., increasing frequency of omnivores and green sunfish or other tolerant species); older age classes of top predators may be rare.
28-34	Poor	Dominated by omnivores, tolerant forms, and habitat generalists; few top carnivores; growth rates and condition factors commonly depressed; hybrids and diseased fish often present.
12-22	Very poor	Few fish present, mostly introduced or tolerant forms; hybrids common; disease, parasites fin damage, and other anomalies regular.
	No fish	Repeated sampling finds no fish.

Catch-per-unit-effort analysis was performed for three large rivers sampled during 2008. Total time spent electrofishing at each site was used to calculate the CPUE estimates for each species collected. Length categorization analysis (Gabelhouse 1984) was used to calculate Proportional Stock Density (PSD) and Relative Stock Density (RSD) for black bass and rock bass populations sampled.

Benthic data collected for the 2008 surveys were subjected to a biotic index that rates stream condition based on the overall taxa tolerance values and the number of Ephemeroptera, Plecoptera, and Trichoptera (EPT) taxa present. The North Carolina Division of Environmental Management (NCDEM) has developed a bioclassification index and associated criteria for the southeastern United States (Lenat 1993). This technique rates water quality according to scores derived from taxa tolerance values and EPT taxa richness values. The final derivation of the water quality classification is based on the combination of scores generated from the two indices. The criteria used to generate the biotic index values and EPT values are as follows:

Score	Biotic Index Values	EPT Values
5 (Excellent)	< 5.14	> 33
4.6	5.14-5.18	32-33
4.4	5.19-5.23	30-31
4 (Good)	5.24-5.73	26-29
3.6	5.74-5.78	24-25
3.4	5.79-5.83	22-23
3	5.84-6.43	18-21
2.6	6.44-6.48	16-17
2.4	6.49-6.53	14-15
2	6.54-7.43	10-13
1.6	7.44-7.48	8-9
1.4	7.49-7.53	6-7
1 (Poor)	> 7.53	0-5

The overall result is an index of water quality that is designed to give a general state of pollution regardless of the source (Lenat 1993). Taxa tolerance rankings were based on those given by NCDEM (1995) with minor modifications for taxa, which did not have assigned tolerance values.

Clinch River

Introduction

The Clinch River represents an important recreational resource for the state both in consumptive and non-consumptive uses. It provides critical habitat for threatened and endangered species and species of special concern. The river supports a diverse fish community and has been documented to host some 43 species of mussels (Ahlstedt 1986). Additionally, it supports one of east Tennessee's better warmwater sport fisheries. The Clinch River has been the focus of numerous surveys and investigations conducted by both state and federal agencies with the major purpose of assessing and monitoring the fish and benthic communities. The Agency has made limited surveys of the river that focused primarily on collecting basic fish, benthic, and water quality data (Bivens 1988, Carter et al. 2000, 2003, 2006). Our survey of the Clinch River focused on re-evaluating the sport fish population originally sampled in 1999. Our 2008 assessment was derived from nine sample sites located between river mile 202 and river mile 152. After our initial evaluation in 1999, the Clinch River was put into a 3-year rotational schedule with eight other rivers in the region. Sport fish sampling sites were reduced to those that would best characterize these populations. In March 2008, smallmouth bass regulations were changed to a protected slot limit (PLR) which prohibits the take of bass between 13 and 17 inches. The regulation allows anglers to keep one bass in excess of 17 inches as part of the five fish daily creel limit.

Study Area and Methods

The Clinch River originates in Virginia and flows in a southwesterly direction before emptying into Norris Reservoir near river mile 152. The river has a drainage area of approximately 3,838 kilometers^2 (upstream of the reservoir). In Tennessee, all of the Clinch River flows through the Ridge and Valley province of east Tennessee coursing by the town of Sneedville before emptying into Norris Reservoir just northwest of Thorn Hill. Public access along the river is primarily limited to bridge crossings and small "pull-outs" along roads paralleling the river. There are several primitive launching areas for canoes or small boats and three developed launching areas

managed by the Tennessee Wildlife Resources Agency (Kyles Ford, Sneedeville, Hwy. 25E Bridge).

Between May 2 and 22, 2008, we conducted nine fish surveys between the Virginia state line and Norris Reservoir (Figure 1). In our survey sites, the riparian habitat consisted primarily of wooded shorelines with interspersed agricultural fields. Submerged woody debri was fairly common in most of our sample areas. The river substrate was predominately boulder/cobble in riffle areas and bedrock with interspersed boulder/cobble in the pool habitat. Measured mean channel widths ranged from 41.6 meters to 71.5 meters, while site lengths fell between 190 meters and 890 meters (Table 1). Water temperatures ranged from 15 C to 19 C and conductivity varied from 235 to 305 µs/cm (Table 1).

Figure 1. Site locations for samples conducted in the Clinch River during 2008.

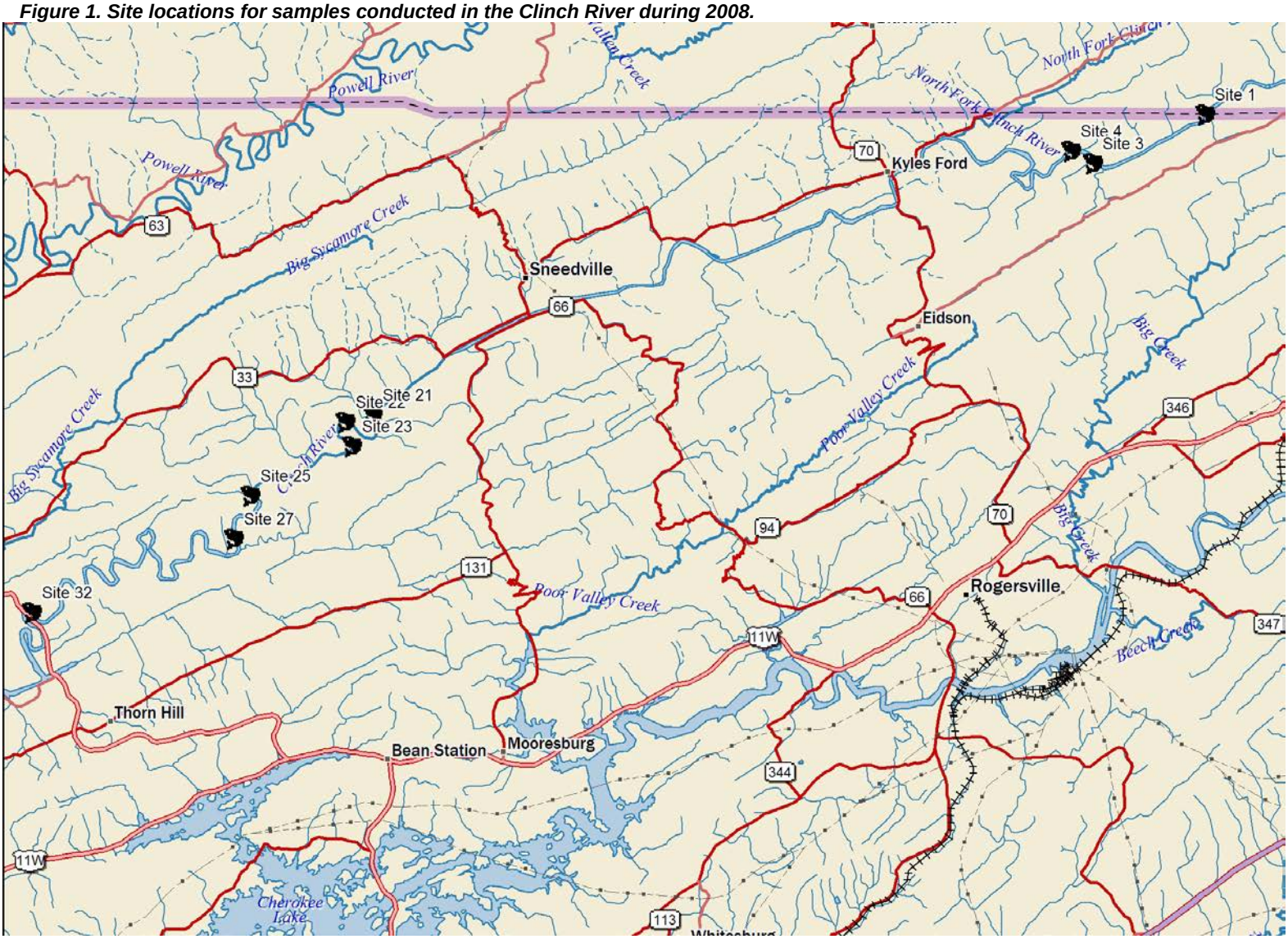


Table 1. Physiochemical and site location data for samples conducted in the Clinch River during 2008.

Site Code	Site	Quad	River Mile	Latitude	Longitude	Mean Width (m)	Length (m)	Temp. C	Cond. µs/cm	Secchi (m)
420080501	1	Looney Gap	202	36.59361	-82.88944	44.6	376	17	283	2.0
420080503	3	Looney Gap	199	36.57667	-82.94139	41.6	381	17.5	305	2.0
420080504	4	Looney Gap	197.8	36.58139	-82.95444	50.6	190	17.5	305	2.0
420080521	21	Swan Island	172.5	36.47722	-83.28917	53	718	15	235	1.5
420080522	22	Swan Island	170.7	36.47528	-83.30306	71.5	480	16	240	1.5
420080523	23	Swan Island	169.6	36.46500	-83.30083	50	217	16	235	1.5
420080525	25	Swan Island	166.6	36.44583	-83.34917	63	890	17	240	1.5
420080527	27	Swan Island	164.5	36.42917	-83.35778	68.5	520	18.5	250	1.5
420080532	32	Howard Quarter	152.2	36.40139	-83.45250	71.5	413	19	250	1.5

Fish were collected by boat electrofishing in accordance with the standard large river sampling protocols (TWRA 1998). Fixed-boom electrodes were used to transfer 4-5 amps DC at all sites. This current setting was determined effective in narcotizing all target species (black bass and rock bass). All sites were sampled during daylight hours and had survey durations ranging from 900 to 982 seconds. Catch-per-unit-effort (CPUE) values were calculated for each target species at each site. Length categorization indices were calculated for target species following Gabelhouse (1984).

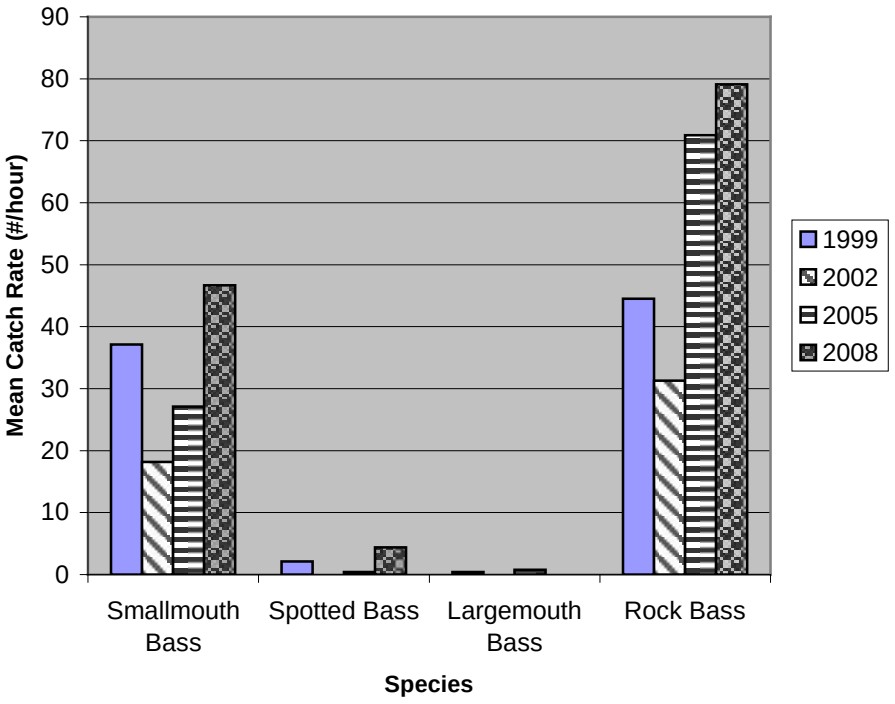
Results

CPUE estimates for smallmouth bass averaged 46.7/hour (SD 15.4), while the mean rock bass estimate was 79.1/hour (SD 43.1) (Table 2). Unlike our 2005 survey, we did not collect any largemouth bass, although spotted bass were present in low numbers. The CPUE estimate for spotted bass was 4.4 (SD 11.9). Comparatively, there was an overall increase in the mean catch rate of smallmouth bass from our survey in 2005 (Figure 2). The mean catch rate of smallmouth bass increased 72% over the value observed in 2005 and was the highest recorded value for this species since sampling began in 1999. Likewise, the mean catch rate for rock bass increased about 12% from our sample taken in 2005. Almost all of the sample sites showed increases in CPUE for both smallmouth bass and rock bass when compared to the 2005 survey.

Table 2. Catch per unit effort and length categorization indices of target species collected in the Clinch River during 2008.

Site Code	Smallmouth Bass CPUE	Spotted Bass CPUE	Largemouth Bass CPUE	Rock Bass CPUE
420080501	56	-	-	40
420080503	60	-	-	64
420080504	24	-	-	20
420080521	32	-	-	52
420080822	38	-	-	146
420080523	44	-	-	76
420080525	36	4	-	128
420080527	63	-	-	122
420080532	68	36	-	64
MEAN	46.7	4.4	-	79.1
STD. DEV.	15.4	11.9	-	43.1
	Length-Categorization Analysis	**Length-Categorization Analysis**	**Length-Categorization Analysis**	**Length-Categorization Analysis**
	PSD = 15	PSD = 0	PSD = 0	PSD = 36.7
	RSD-PREFERRED = 6.6	RSD-PREFERRED = 0	RSD-PREFERRED = 0	RSD-PREFERRED = 3.0
	RSD-MEMORABLE = 1.6	RSD-MEMORABLE = 0	RSD-MEMORABLE = 0	RSD-MEMORABLE = 0
	RSD- TROPHY = 0	RSD- TROPHY = 0	RSD- TROPHY = 0	RSD- TROPHY = 0

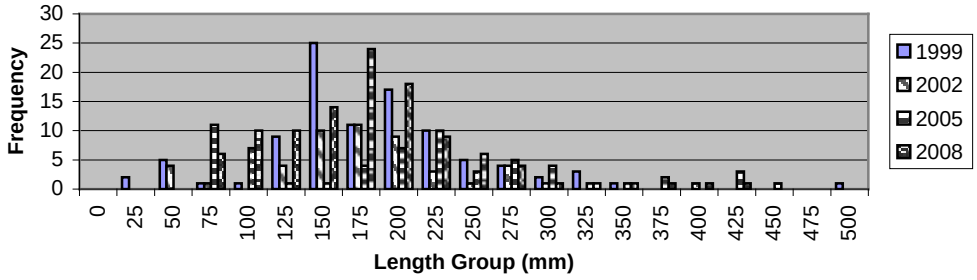
Figure 2. Trends in mean catch rate of black bass and rock bass collected from 1999 to 2008 in the Clinch River.



The size distribution of smallmouth bass between 1999 and 2008 changed somewhat among our nine sampling stations (Figure 3). Good recruitment for bass 125 mm and less indicated a good year class in 2007. The occurrence of

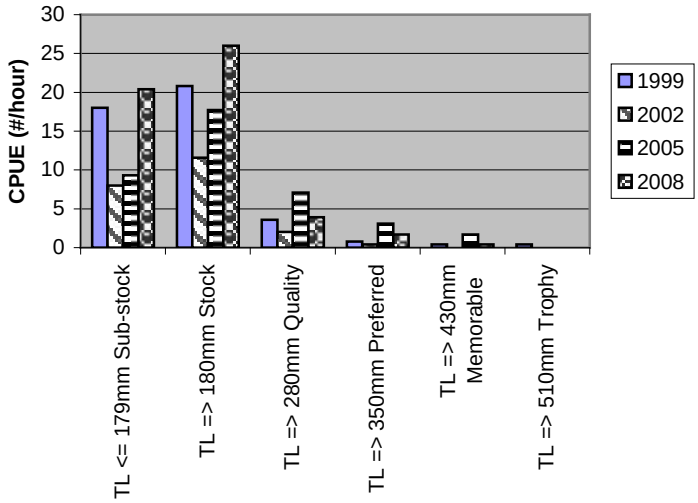
quality size bass 250 mm and larger was generally lower in 2008 when compared to 2005. The majority of smalllmouth bass fell between the 100 and 225 mm size range with the highest frequency of fish in the 150 to 175 mm size class. Given the high frequency of fish between 150 and 250 mm, there should be a good number of bass recruiting to quality size over the next 3 to 5 years.

Figure 3. Length frequency distributions for smallmouth bass collected in the Clinch River from 1999 to 2008.



Length categorization analysis indicated the relative stock density (RSD) of preferred smallmouth bass (TL ≥ 350 mm) was 6.6 (Table 2). This was a 62% decrease from the value recorded in 2005. RSD for memorable (TL ≥ 430 mm) size bass decreased form 10 in 2005 to 1.6 in 2008 (84%). Trophy (TL ≥ 510 size bass were not collected in 2008. The only recorded bass that has been large enough to meet the trophy criteria was collected in 1999. We are certain that bass in 20 inches and larger inhabit the river although the percentage that these fish contribute to the total population is certainly low. The PSD of smallmouth bass (ratio of quality size bass to stock size bass) was 15. This was down substantially from the value recorded in 2005 (40). The significant drop in quality size bass was the major influence in the observed decrease. Catch per unit effort estimates by RSD category indicated substantial increases in the catch rates in the sub-stock and stock categories, while larger size categories (Quality-Memorable) exhibited decreases (Figure 4). The observed decreases in the

Figure 4. Relative stock density (RSD) catch per unit effort for smallmouth bass collected in the Clinch River from 1999 to 2008.



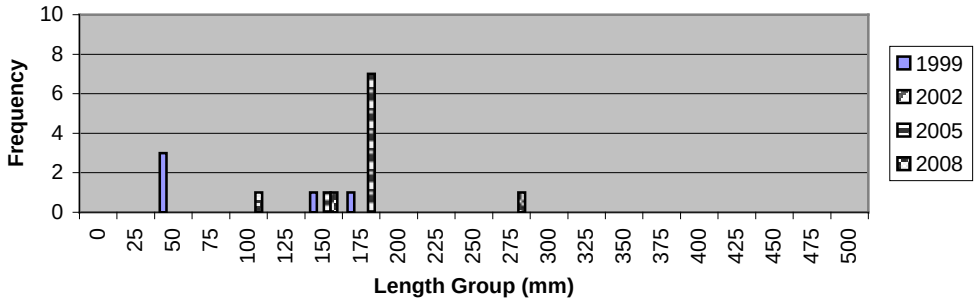
larger size classes most likely reflect the flooding impacts of 2003 and drought conditions in 2007-08.

Age and growth characteristics for the smallmouth bass population in the Clinch River were characterized in 1999 (Carter et al. 2000). For the most part, the Clinch River has had growth rates similar to other large river populations with the same age structure.

We did not collect otoliths from smallmouth bass in 2008, assuming that the values generated from the 1999 survey typify the general growth characteristics of this population. In general it takes a smallmouth bass in the Clinch River about 4.7 years to reach 305 mm (12 inches), and about 7.8 years to attain a length of 406 mm (16 inches).

There were ten spotted bass collected from the Clinch River in 2008. All of these fish were collected at the most downstream site (32). Given the scarcity of spotted bass in the Clinch, no real inferences about their contribution to the fishery can be made. However, they do persist in the river and may offer some opportunity to anglers. Figure 5 portrays the distribution of lengths for spotted bass collected from the Clinch River between 1999 and 2008. Catch rate for spotted bass averaged 4.4/hour (SD 11.9).

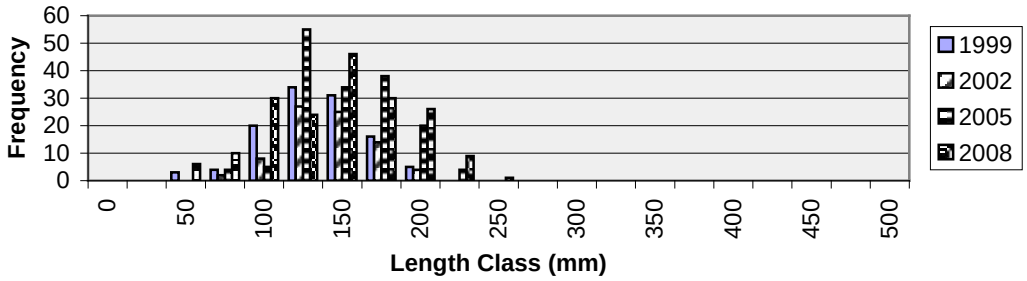
Figure 5. Length frequency distributions for spotted bass collected in the Clinch River from 1999 to 2008.



Although largemouth bass have been present on occasion (1999 and 2002), their numbers have been extremely low and quite inconsequential to the overall fishery. No largemouth bass have been observed in the river since 2002 although there is certainly some influx of largemouth bass from Norris Reservoir in the lower reaches of the river.

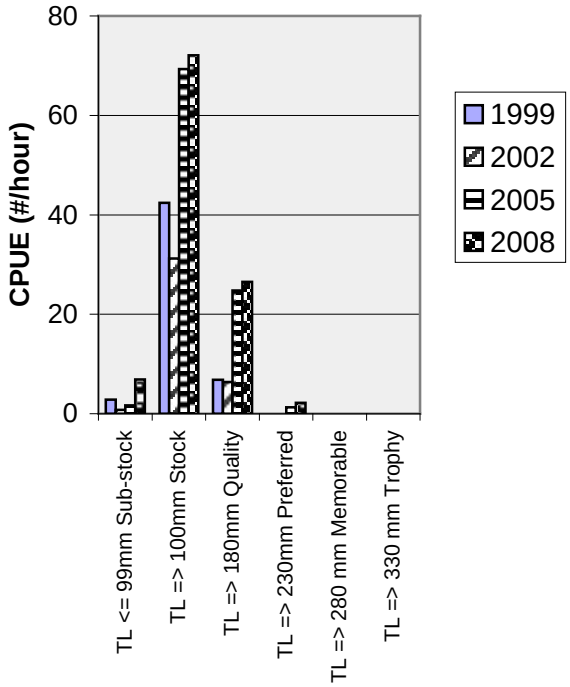
Individuals in the 100 to 225 mm range represented the majority of rock bass in our samples between 1999 and 2008 (Figure 6). For the most part, we observed increases in all size classes over 150 mm and collected one fish that was approaching 10 inches. Generally, our 2008 survey proved to be our best sample of rock bass since monitoring was initiated in 1999. We believe that our spring sample strategy has allowed us to more effectively capture this species and aid us in more accurately depicting the population size structure.

Figure 6. Length frequency distributions for rock bass collected in the Clinch River from 1999 to 2008.



Relative stock density (RSD) analysis indicated the RSD for preferred rock bass (TL ≥ 230 mm) was 3.0 (1.9 in 2005). RSD for both memorable (TL ≥ 280 mm) and trophy (TL ≥ 330 mm) size rock bass was 0. The PSD of rock bass increased over our 2005 survey (35.8) to 36.7. Our catch values by RSD category increased slightly over the value observed in 2005 (Figure 7). All RSD categories showed increases over previous years with the most noticeable increase in the sub-stock category.

Figure 7. Relative stock density (RSD) catch per unit effort for rock bass collected in the Clinch River from 1999 to 2008.



Because of our confidence in determining age and growth characteristics (based on previous samples) we did not collect any otolith samples from rock bass in 2008. Therefore, no mortality or potential population growth statistics could be calculated. Age and growth and mortality of rock bass in the Clinch River are assumed to be similar to those reported from our 1999 assessment (Carter et al. 2000).

Discussion

The Clinch River provides anglers with the opportunity to catch all species of black bass along with rock bass. Because of the low numbers of spotted and largemouth bass the Clinch River, it should not be considered to a sport fishery for these species.

The popularity of this riverine fishery has grown over the last few years and now hosts a good percentage of anglers from Kentucky. Currently we have no angler use/harvest data on the river to aid in evaluating the effects that angler use may or may not have on the sport fishery. It is imperative that we obtain this data in order to answer fisheries management questions, public inquiries, and aid in the development of regulations.

The occurrence of musky in the river warrants continued investigations. The consistent stockings made by the Virginia Department of Game and Inland Fisheries upstream of the state line could lead to the development of a fishery in the Tennessee portion of the Clinch River. According to Tom Hampton (VAGF) their stockings have been quite successful and have resulted in the establishment of a sport fishery. Recent Index of Biotic Integrity surveys by TVA have indicated that the Clinch River is in “good” condition based on data from two long-term monitoring stations.

Surveys on the Clinch River will be conducted on a three-year rotation in order to assess any changes in the fishery. Our return trip in 2011 will in all likelihood focus on the sample sites surveyed in 2008, providing no new or more efficient sampling scheme is developed.

Management Recommendations

1. Initiate an angler use and harvest survey.

2. Develop a fishery management plan for the river.

Powell River

Introduction

The remoteness of the Powell River makes it one of the premier warmwater rivers in east Tennessee. It offers the opportunity to take float trips without seeing another individual during the course of a day. The surroundings are appealing which makes a trip to the Powell well worth the drive. It is an important recreational resource for the state both in consumptive and non-consumptive uses. It provides critical habitat for threatened and endangered species and species of special concern. The river supports a diverse fish community and has been documented to host some 37 species of mussels (Ahlstedt 1986). It is one of only two rivers in the region having reaches designated as mussel sanctuaries. Additionally, it supports one of east Tennessee's better warmwater sport fisheries. The Powell River has been the focus of numerous surveys and investigations conducted by other state and federal agencies with the major purpose of assessing and monitoring the fish and benthic communities. The Agency has made limited surveys of the river that focused primarily on collecting basic fish, benthic, and water quality data (Bivens 1988, Carter et al. 2000, 2003, 2004, 2006). Our survey of the Powell River focused on re-evaluating the sport fish population originally sampled in 1999. Our 2008 assessment was derived from eight sample sites located between river mile 115 and river mile 75. We were unable to sample our two most downstream sites to due to boat problems and low water flows. After our initial evaluation in 1999, the Powell River was put into a 3-year rotational schedule with eight other rivers in the region. Sport fish sampling sites were reduced to those that would best characterize these populations. In March 2008, smallmouth bass regulations were changed to a protected slot limit (PLR) which prohibits the take of bass between 13 and 17 inches. The regulation allows anglers to keep one bass in excess of 17 inches as part of the five fish daily creel limit.

Study Area and Methods

The Powell River originates in Virginia and flows in a southwesterly direction before emptying into Norris Reservoir near river mile 54. The river has a drainage area of approximately 1,774 kilometers^2. In Tennessee, all of the Powell River flows through the Ridge and Valley province of east Tennessee coursing by the town of Harrogate before emptying into Norris Reservoir near the community of Arthur. Public access along the river is primarily limited to bridge crossings and small

"pull-outs" along roads paralleling the river. There are several primitive launching areas for canoes or small boats and one developed launching area managed by the Tennessee Wildlife Resources Agency (Mulberry Creek).

Between April 18 and May 1, 2008, we conducted eight fish surveys between the Virginia state line and Norris Reservoir (Figure 8). In our survey sites, the riparian habitat consisted primarily of wooded shorelines with interspersed agricultural fields. Submerged woody debri and water willow were fairly common in most of our sample areas. The river substrate was predominately boulder/cobble in riffle areas and bedrock with interspersed boulder/cobble in the pool habitat. Measured mean channel widths ranged from 29.5 meters to 52.0 meters, while site lengths fell between 290 meters and 649 meters (Table 3). Water temperatures ranged from 14 C to 17.5 C and conductivity varied from 350 to 380 µs/cm (Table 3).

Figure 8. Site locations for samples conducted in the Powell River during 2008.

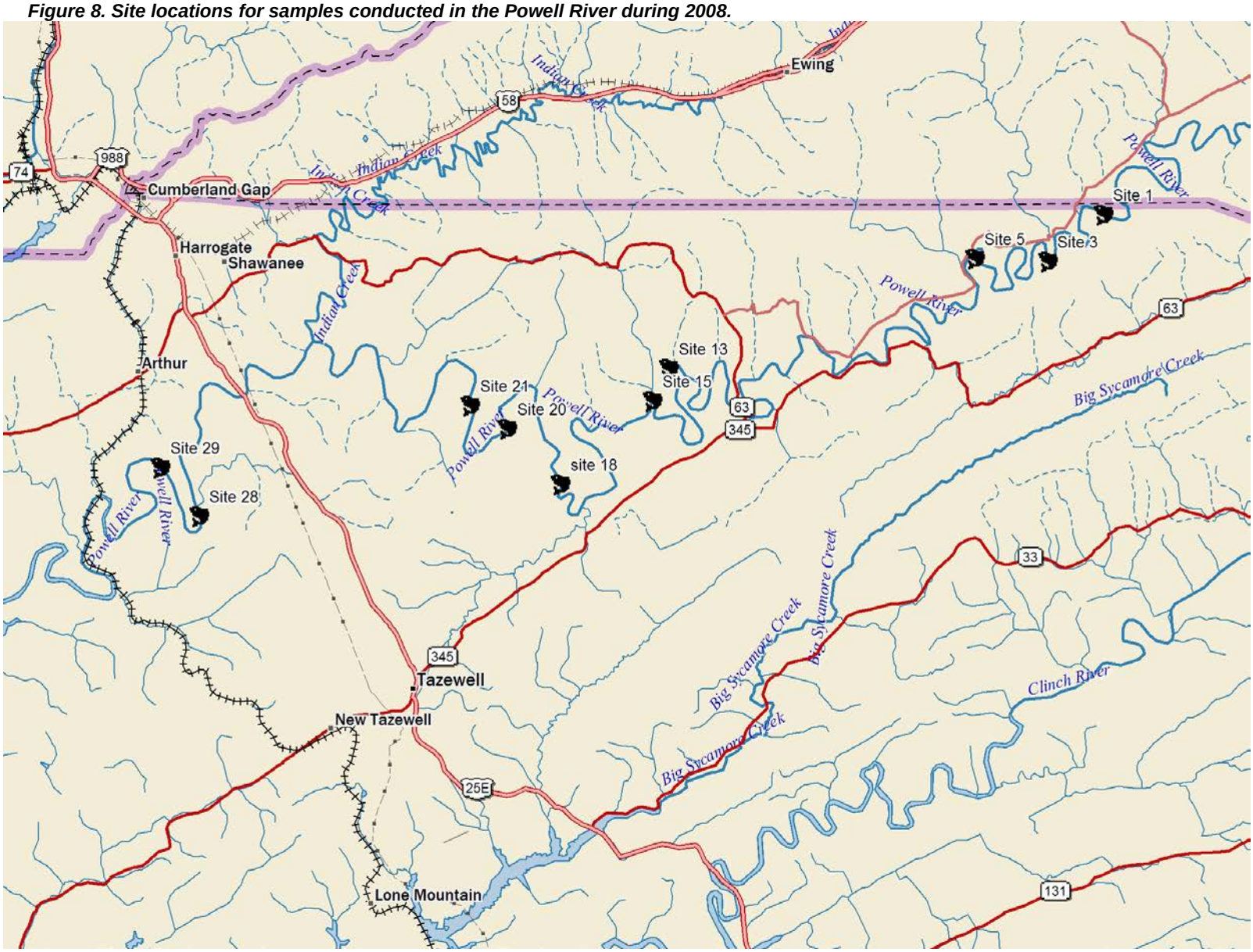


Table 3. Physiochemical and site location data for samples conducted in the Powell River during 2008.

Site Code	Site	Quad	River Mile	Latitude	Longitude	Mean Width (m)	Length (m)	Temp. C	Cond. µs/cm	Secchi (m)
420080401	1	Back Valley	115	36.59472	-83.31444	29.5	290	16	350	2+
420080403	3	Back Valley	112.1	36.58111	-83.33472	30	577	16	350	2+
420080405	5	Back Valley	107.6	36.58194	-83.36194	33.5	480	16	350	2+
420080413	13	Coleman Gap	91	36.54917	-83.47417	38.5	537	17.5	380	1.6
420080415	15	Coleman Gap	87.1	36.53972	-83.48028	39	649	17.5	380	1.6
420080418	18	Wheeler	81	36.51500	-83.51444	40	383	17	380	1.6
420080420	20	Wheeler	77.3	36.53139	-83.53389	38	570	14	370	2.0
420080421	21	Wheeler	75	36.53833	-83.54750	38.5	467	15	370	2.0
420080428 ***(no sample)***	28	Middlesboro South	61	36.50528	-83.64861	52	452	-	-	-
420080429 ***(no sample)***	29	Middlesboro South	59	36.51981	-83.66189	41.5	479	-	-	-

Fish were collected by boat electrofishing in accordance with the standard large river sampling protocols (TWRA 1998). Fixed-boom electrodes were used to transfer 4-5 amps DC at all sites. This current setting was determined effective in narcotizing all target species (black bass and rock bass). All sites were sampled during daylight hours and had survey durations ranging from 900 to 911 seconds. Catch-per-unit-effort (CPUE) values were calculated for each target species at each site. Length categorization indices were calculated for target species following Gabelhouse (1984).

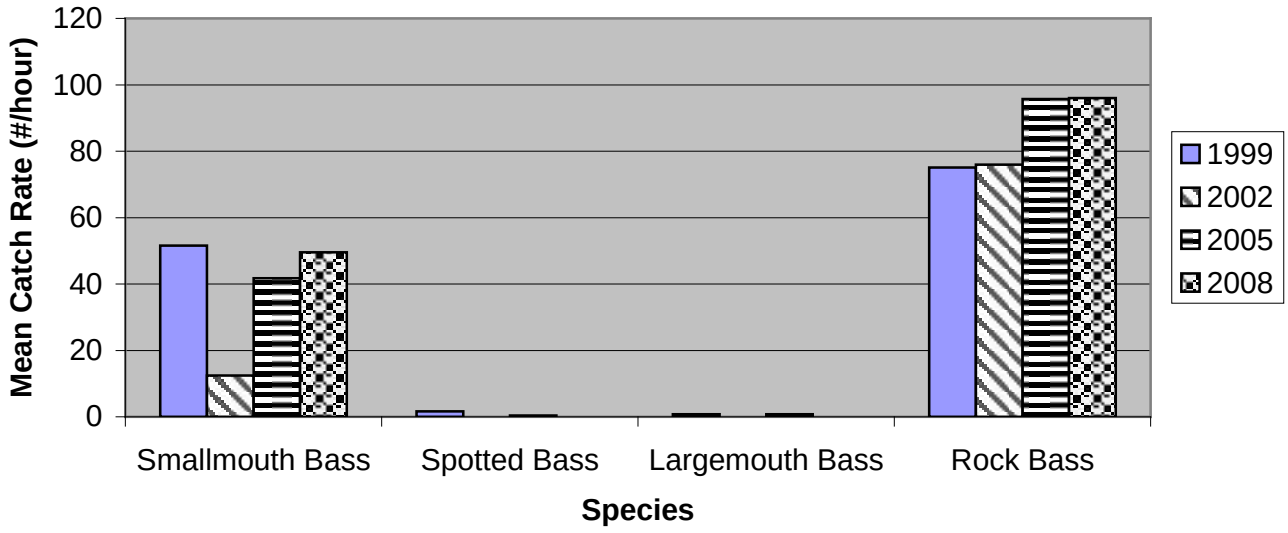
Results

CPUE estimates for smallmouth bass averaged 49.5/hour (SD 16.8), while the mean rock bass estimate was 96/hour (SD 58.2)(Table 4). Comparatively, there was a slight increase (19%) in the catch of smallmouth bass and likewise rock bass exhibited a very slight 0.3% increase over the value recorded in 2005 (Figure 9). However, the 2008 value for smallmouth bass did fall slightly under the value recorded in 1999. Unlike 2005, there were no spotted bass or largemouth bass collected which may have been an artifact of us not sampling the lower two sites on the river. Overall, the contribution of largemouth bass and spotted bass to the overall fishery has been insignificant in past surveys.

Table 4. Catch per unit effort and length categorization indices of target species collected in the Powell River during 2008.

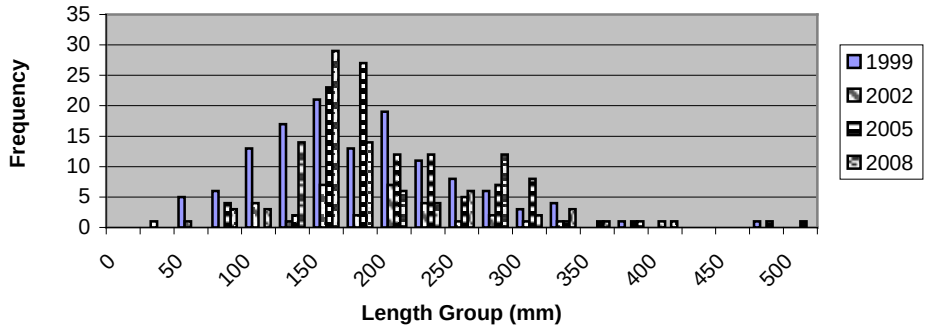
Site Code	Smallmouth Bass CPUE	Spotted Bass CPUE	Largemouth Bass CPUE	Rock Bass CPUE
420080401	52	-	-	36
420080403	56	-	-	68
420080405	76	-	-	116
420080413	48	-	-	216
420080415	52	-	-	112
420080418	28	-	-	56
420080420	60	-	-	116
420080421	24	-	-	48
420080428	-	-	-	-
420080429	-	-	-	-
MEAN	49.5			96
STD. DEV.	16.8			58.2
	Length-Categorization Analysis	**Length-Categorization Analysis**	**Length-Categorization Analysis**	**Length-Categorization Analysis**
	PSD = 36.2	PSD = 0	PSD = 0	PSD = 28.7
	RSD-PREFERRED = 6.4	RSD-PREFERRED = 0	RSD-PREFERRED = 0	RSD-PREFERRED = 0.5
	RSD-MEMORABLE = 0	RSD-MEMORABLE = 0	RSD-MEMORABLE = 0	RSD-MEMORABLE = 0
	RSD- TROPHY = 0	RSD- TROPHY = 0	RSD- TROPHY = 0	RSD- TROPHY = 0

Figure 9. Trends in mean catch rate of black bass and rock bass collected from 1999 to 2008 in the Powell River.



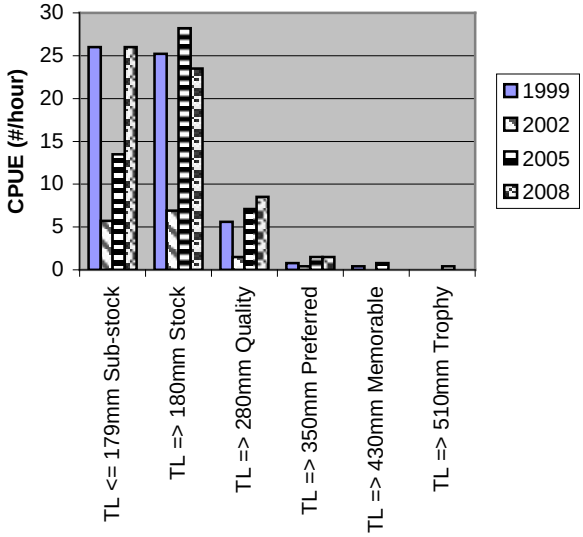
The size distribution of smallmouth bass between 2005 and 2008 changed somewhat among our sampling stations (Figure 10). We did observe an increase in the number of bass in the 150 mm size group, the highest we have observed since 1999. Generally, we observed good recruitment into size classes above 6 inches with the exception of the 8 to 10 inch groups which were below those values recorded in 2005. With the number of smaller bass observed in the 2008 sample there should be good recruitment into the larger size classes over the next three years. Smallmouth bass 14 inches and greater were as abundant in 2008 as they were in 2005. This was surprising given the drought conditions in the river over the last two years.

Figure 10. Length frequency distributions for smallmouth bass collected in the Powell River from 1999 to 2008.



Length categorization analysis indicated the relative stock density (RSD) of preferred smallmouth bass (TL ≥ 350 mm) was 6.4 which increased slightly from 2005 (Table 4). RSD for memorable (TL ≥ 430 mm) and trophy (TL ≥ 510 mm) size bass was 0. The PSD of smallmouth bass (ratio of quality size bass to stock size bass) increased from 25.3 in 2005 to 36.2 in 2008 (Table 4). Generally, we observed increases in those RSD categories that are consistently represented in our surveys with the exception of the RDS-stock category (Figure 11). There was a considerable increase in the catch rate of sub-stock bass which should result in good recruitment to the larger size classes over the next few years. We did not collect any bass in the memorable or trophy categories. These size groups are always represented with low numbers and given the recent drought conditions in the river these size groups would be most susceptible to mortality. There were no spotted bass or largemouth bass collected in the 2008 surveys. Historically, these species contribution to the overall fishery has been insignificant.

Figure 11. Relative stock density (RSD) catch per unit effort for smallmouth bass collected in the Powell River from 1999 to 2008.

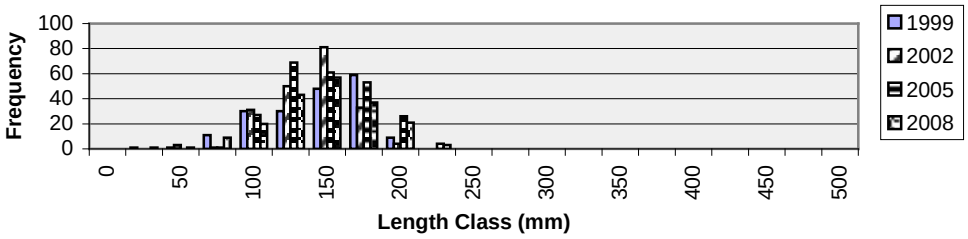


Age and growth characteristics for the smallmouth bass population in the Powell River were characterized in 1999 (Carter et al. 2000). For the most part, the Powell River has had growth rates somewhat slower than other large river

populations with the same age structure. We did not collect otoliths from smallmouth bass in 2008, assuming that the values generated from the 1999 survey typify the general growth characteristics of this population. In general, it takes a smallmouth bass in the Powell River about 5.2 years to reach 305 mm (12 inches), and about 9.5 years to attain a length of 406 mm (16 inches).

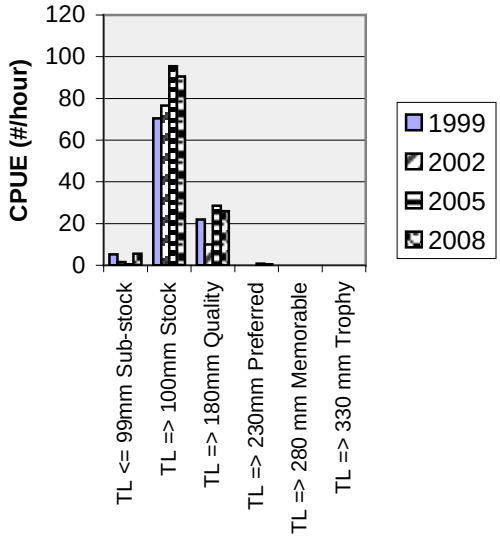
Individuals in the 100 to 175 mm range represented the majority of rock bass in our samples in 2008 (Figure 12). For the most part, the distributions among years were fairly similar, although there were fewer representatives in each size class during 2008.

Figure 12. Length frequency distributions for rock bass collected in the Powell River from 1999 to 2008.



Length categorization analysis indicated the RSD for preferred rock bass (TL $\geq$ 230 mm) was 0.5, which was down slightly from 2005. RSD for both memorable (TL $\geq$ 280 mm) and trophy (TL $\geq$ 330 mm) size rock bass was 0. The PSD of rock bass was 28.7 which was also a slight decrease from the value observed in 2005 (Table 4). For the most part, the general trend observed in 2005 continued in 2008, although there was a slight decrease in the number of fish in the RSD-stock and RSD-quality categories (Figure 13). We did collect one rock bass in the preferred category during the 2008 surveys.

Figure 13. Relative stock density (RSD) catch per unit effort for rock bass collected in the Powell River from 1999 to 2008.



Because of our confidence in determining age and growth characteristics (based on previous samples) we did not collect any otolith samples from rock bass in 2008. Therefore, no mortality or potential population growth statistics could be calculated. Age and growth and mortality of rock bass in the Powell River are assumed to be similar to those reported from our 1999 assessment (Carter et al. 2000).

Discussion

The Powell River provides anglers with the opportunity to catch all species of black bass along with rock bass. Because of the low numbers of spotted and largemouth bass in the Powell River, it should not be considered a sport fishery for these species.

The popularity of this riverine fishery is continuing to grow as more anglers shift from reservoir habitats to rivers. This trend will undoubtedly continue as the use on reservoirs increases. This type of potential for exploitation of riverine fisheries requires angler use/harvest data collection in order to effectively manage the resource. It is imperative that we obtain this data in order to answer fish management questions, public inquiries, and aid in the development of regulations. Recent Index of Biotic Integrity surveys by TVA have indicated that the Powell River is in "good to excellent" condition based on data from one long-term monitoring station.

Overall the Powell River represents one of east Tennessee's premier warmwater river resources. It provides anglers with the opportunity to catch good numbers of smallmouth bass and rock bass and has the potential of producing memorable catches (both in number and size). The surrounding landscape is as eye appealing as the wildlife that lives in and around the river. It provides an excellent escape for recreationists (consumptive and non-consumptive) who are looking for a river that offers relatively undisturbed surroundings and a diverse community of wildlife.

Despite record drought, the smallmouth and rock bass populations in the river seem to have been able to persist at levels similar to pre-drought conditions, although we suspect that the situation was stressful to these segments of the fish community. Surveys on the Powell River will be conducted on a three-year rotation in order to assess any changes in the fishery. Our return trip in 2011 will in all likelihood repeat those samples conducted in 2008.

Management Recommendations

1. Initiate an angler use and harvest survey.

2. Develop a fishery management plan for the river.

Little River

Introduction

Little River originates in Sevier County on the north slope of Clingmans Dome, in the Great Smoky Mountains National Park. It flows in a northwesterly direction for about 95 kilometers, past Elkmont in the National Park, and Townsend, Walland, and Maryville in Blount County, and joins the Tennessee River near river mile 635.6. Fort Loudoun Reservoir, impounds the lower 6.8 miles of Little River with another 1.5 miles being impounded by the low head dam at Rockford (located at the backwaters of Fort Loudoun). In all, a little over eight river miles are impounded. Another 0.75 mile or so is impounded by Perrys Milldam downstream of Walland, near river mile 22. A third low head dam is located in Townsend near river mile 33.6. The river has a drainage area of approximately 982 km^2 at its confluence with the Tennessee River. The upper reach of the river (upstream of Walland) is located in the Blue Ridge physiographic province, and then transitions into the Ridge and Valley province from Walland to Fort Loudoun Reservoir. Little River is a very scenic stream in the Great Smoky Mountains National Park. There, it drains an area containing some of the most spectacular scenery in the southeastern United States. The Little River fishery within the National Park boundary is primarily wild rainbow and brown trout with smallmouth bass in the lower reaches. An excellent trout fishery exists, and is managed by the National Park Service. Little River's gradient becomes moderate as it leaves the National Park and flows through the Tuckaleechee Valley from Townsend to Walland. Excellent populations of smallmouth bass and rock bass exist there, and rainbow trout are stocked in spring and fall as water temperatures allow. This portion of the river has many developed campgrounds and is a popular recreation destination for tourists. While not as developed as Pigeon Forge, the Townsend area has grown significantly over the past two decades. Downstream of Walland, Little River leaves the mountains and no longer displays the extreme clarity and attractive

Little River at Perrys Mill

rocky bottom of its upper reaches. Here it enters the Ridge and Valley province and resembles the more typical large river habitat with lower gradient and large deep pools interspersed with shallow shoal areas. Downstream of Perrys Milldam, the fishery, while still primarily smallmouth bass and rock bass, declines in quality relative to the upstream reach. This is probably related to limited availability of preferred smallmouth bass habitat. Near the small community of Rockford, Little River flows into a surprisingly large (given the size of the stream) embayment of Fort Loudon Lake. The Little River forms the boundary between Blount County and Knox County for the last few miles of its course.

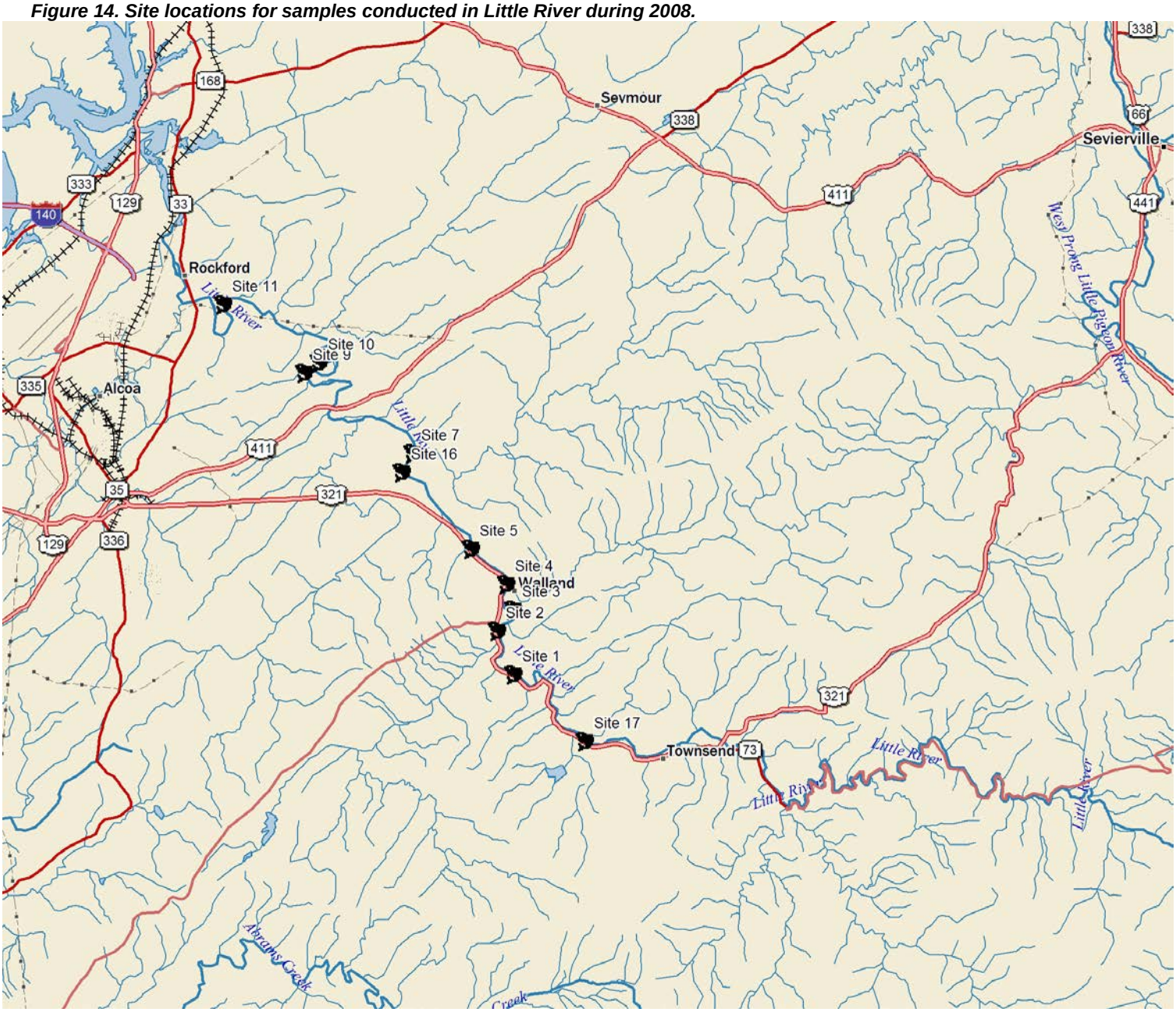
Little River represents an important recreational resource for the state both in consumptive and non-consumptive uses. It supports an active tubing/rafting industry and is an important recreational resource for local residents and tourists alike. It is also the municipal water source of the cities of Alcoa and Maryville. It provides critical habitat for species of special concern and is home to over 50 species of fish (four listed federally). Additionally, its upper reach supports one of east Tennessee's better warm water sport fisheries. It provides anglers with the opportunity to catch all species of black bass, rock bass, and even stocked rainbow trout when water temperatures allow.

Study Area and Methods

Our 2008 survey of Little River consisted of two IBI sites (Coulters Bridge and Townsend) and nine CPUE black bass/rock bass samples. We cooperated with several agencies in conducting the two IBI samples between July 10 and 13. CPUE samples were conducted on April 1 and April 9. The Coulters Bridge site (16) is located in the Ridge and Valley Province of Blount County while the Townsend site (17) lies in the transitional zone between the Blue Ridge and the Ridge and Valley Provinces (Figure 14).

Public access along the river is primarily limited to bridge crossings and small “pull-outs” along roads paralleling the river. There are several primitive launching areas for canoes or small boats and one developed access area managed by the Agency (Perrys Mill).

Figure 14. Site locations for samples conducted in Little River during 2008.



Fish were collected by boat electrofishing in accordance with the standard large river sampling protocols (TWRA 1998). Fixed-boom electrodes were used to transfer 2-3 amps DC at all sites. This current setting was determined effective in narcotizing all target species (black bass and rock bass). All sites were sampled during daylight hours and had survey durations ranging from 565 to 1400 seconds. Catch-per-unit-effort (CPUE) values were calculated for each

target species at each site. Length categorization indices were calculated for target species following Gabelhouse (1984). For IBI sites, fish were collected according to the criteria described in the methods section of this report. Both backpack and boat electrofishing were used to collect samples at both stations. Qualitative benthic macroinvertebrates were collected at both stations and analyzed to produce a biotic index score similar to those derived for the fish IBI.

Results

In our survey sites, the riparian habitat consisted primarily of wooded shorelines with interspersed agricultural fields. Submerged woody debri was fairly common in most of our sample areas along with large boulder in the upper reaches. The river substrate was predominately boulder/cobble in riffle areas and bedrock with interspersed boulder/cobble in the pool habitat. The prevalence of boulders decreased somewhat as we proceeded downstream and the abundance of gravel and cobble increased. Water temperatures ranged from 11.5 C to 14.5 C and conductivity varied from 30 to 35 µs/cm for those stations where values were recorded (Table 5).

Table 5. Physiochemical and site location data for black bass and rock bass samples conducted in Little River during 2008.

Site Code	Site	Quad	River Mile	Latitude	Longitude	Mean Width (m)	Length (m)	Temp. C	Cond. µs/cm	Secchi (m)
420080301	1	Kinzel Springs	26.6	35.70190	-83.81320	-	-	11.5	30	2
420080302	2	Kinzel Springs	25.1	35.71550	-83.81870	-	-	12.5	32	2
420080303	3	Kinzel Springs	24.6	35.72240	-83.81280	-	-	14.5	30	2
420080304	4	Kinzel Springs	23.8	35.73050	-83.81550	-	-	12.5	35	2
420080305	5	Kinzel Springs	22.6	35.74160	-83.82940	-	-	14	35	2
420080307	7	Wildwood	19.7	35.77180	-83.85190	-	-	-	-	1.5
420080309	9	Maryville	15.3	35.79710	-83.89400	-	-	-	-	1.5
420080310	10	Maryville	14.1	35.80020	-83.88840	-	-	-	-	1.5
420080311	11	Maryville	10.6	35.81880	-83.92520	-	-	-	-	1.5
420080316	16	Wildwood	20.0	35.76580	-83.85630	-	-	-	-	-
420080317	17	Kinzel Springs	29.8	35.68160	-83.78500	-	-	-	-	-

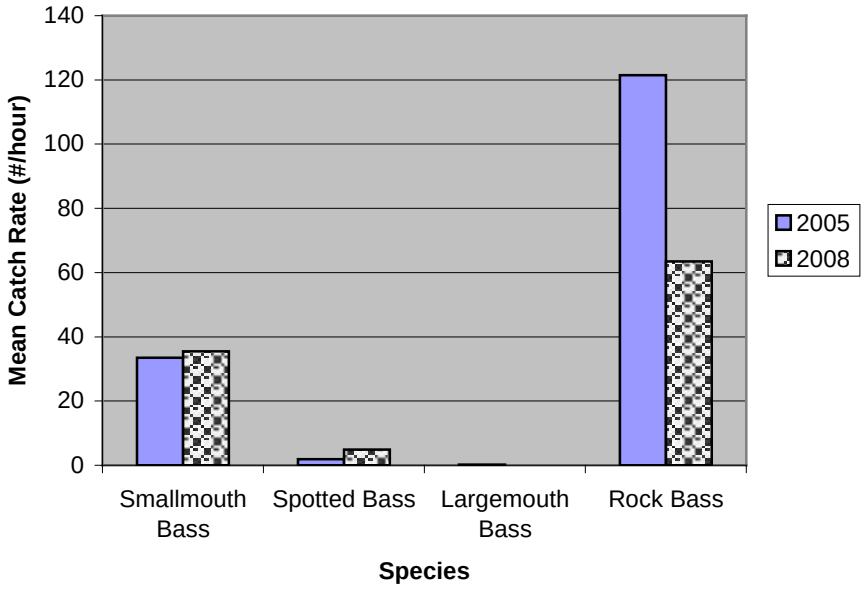
Results

CPUE estimates for smallmouth bass averaged 35.5/hour (SD 23.9) in 2008. This was up 6% from the 2005 value. Mean rock bass estimate was 63.5/hour (SD 39.3) which was down 48% from the previous sample (Table 6). This is probably due to the dewatering of habitat inhabited by rock bass during the last two years. In 2007, the U.S. Geological Survey documented the lowest flow (30 cfs) since the agency began recording data for Little River in 1951. The CPUE estimate for spotted bass was 4.9 (SD 9.1) which was more than double the value recorded in 2005 (Figure 15).

Table 6. Catch per unit effort and length categorization indices of target species collected in Little River during 2008.

Site Code	Smallmouth Bass CPUE	Spotted Bass CPUE	Largemouth Bass CPUE	Rock Bass CPUE
420080301	80.5	-	-	100
420080302	56	-	-	136
420080303	34.6	-	-	50
420080304	31.5	-	-	44.7
420080305	8	-	-	24
420080307	25.9	-	-	20
420080309	6.6	26.6	-	53.3
420080310	24	12	-	44
420080311	52.9	5.8	-	100
MEAN	35.5	4.9		63.5
STD. DEV.	23.9	9.1		39.3
	Length-Categorization Analysis	**Length-Categorization Analysis**	**Length-Categorization Analysis**	**Length-Categorization Analysis**
	PSD = 40	PSD = 20	PSD = 0	PSD = 41.7
	RSD-PREFERRED = 16.6	RSD-PREFERRED = 0	RSD-PREFERRED = 0	RSD-PREFERRED = 9.7
	RSD-MEMORABLE = 8.3	RSD-MEMORABLE = 0	RSD-MEMORABLE = 0	RSD-MEMORABLE = 0
	RSD- TROPHY = 1.6	RSD- TROPHY = 0	RSD- TROPHY = 0	RSD- TROPHY = 0

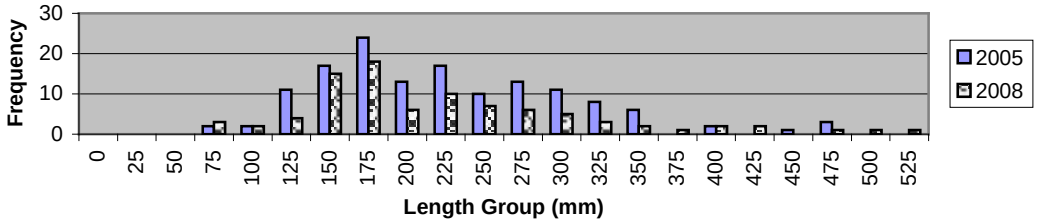
Figure 15. Trends in mean catch rate of black bass and rock bass collected in Little River from 2005 to 2008.



Our observation of mean catch for sport species was not untypical for east Tennessee rivers. Our highest catches were associated with two species, smallmouth bass and rock bass (Figure 15). Spotted bass and largemouth bass followed suit with much lower densities and typical ranking (spotted bass usually higher than largemouth bass). The size distribution of smallmouth bass in Little River was fairly similar to the 2005 survey. Even though our numbers were lower in each size class (due to fewer sample sites) the representation across size groups was consistent. We did observe more bass in excess of 500 mm in the 2008 sample (Figure 16). Although our catch of juvenile bass was low, we did

observe enough bass in these size categories to indicate reproduction and progressive recruitment into larger size classes.

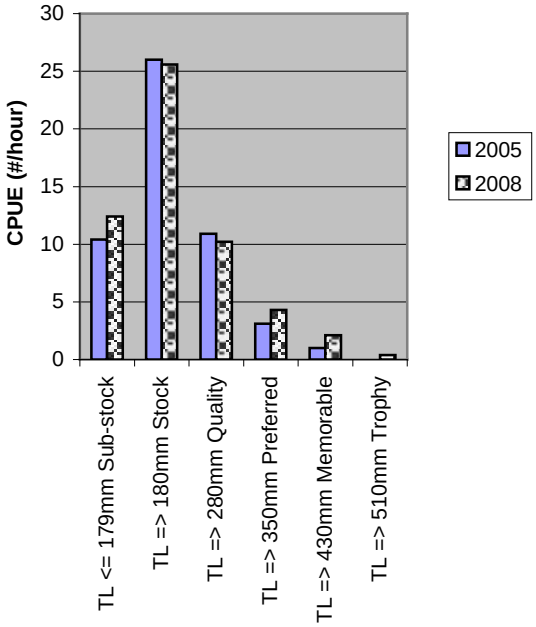
Figure 16. Length frequency distributions for smallmouth bass collected in Little River from 2005 to 2008.



The largest smallmouth bass we collected in 2008 was in the 525 mm class (20 inches). Three fish over 18 inches were also collected.

Length categorization analysis indicated the relative stock density (RSD) of preferred smallmouth bass (TL $\geq$ 350 mm) was 16.6 (Table 6). RSD for memorable (TL $\geq$ 430 mm) and trophy (TL $\geq$ 510 mm) size bass were 8.3 and 1.6, respectively. This was the first occasion we have observed bass in the trophy category in Little River. The PSD of smallmouth bass (ratio of quality size bass to stock size bass) was 40. Our highest catch for the reported RSD categories was for bass of stock size (length $\geq$ 180mm). We did observe a high number of bass in the sub-stock category which is relatively indicative of good reproduction. Overall, the catch for each respective category was fairly similar to to the 2005 values although the RSD-SS, RSD-P, RSD-M, and RSD-T increased (Figure 17).

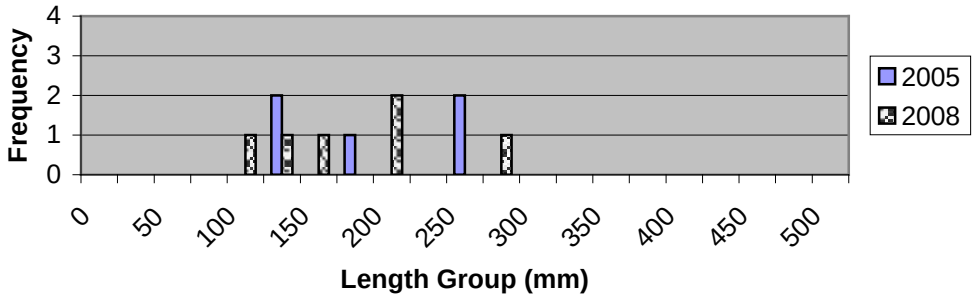
Figure 17. Relative stock density (RSD) catch per unit effort for smallmouth bass collected in Little River from 2005 to 2008.



We did not sample otoliths from smallmouth bass collected in Little River. Since we have no information pertaining to the age and growth of this population, subsequent samples need to include a sub-sample of fish for age and growth analysis.

There were only eight spotted bass collected from the Little River in 2008. These fish ranged in from 108 to 289 mm in length and were collected in the lower reaches of the river. Given the scarcity of spotted bass in Little River, no real inferences about their contribution to the fishery can be made. However, they do persist in the river and may offer some opportunity to anglers. Figure 18 portrays the distribution of lengths for spotted bass collected from Little River during 2008. Catch rate for spotted bass averaged 4.9/hour (SD 9.1).

Figure 18. Length frequency distributions for spotted bass collected in Little River from 2005 to 2008.

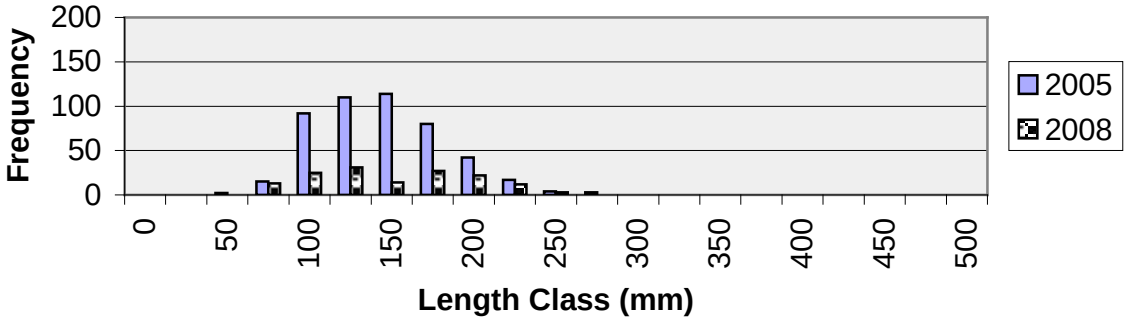


There were no largemouth bass collected during the 2008 survey (1 in 2005). Due to the low abundance of largemouth bass in this river, little can be said about population density and size structure.

Individuals in the 75 to 250 mm range represented the majority of rock bass in our Little River sample during 2008 (Figure 19). The most dramatic observation we had in 2008, was the reduction in our catch rate by nearly half for this species. Although most size groups were still represented in the catch, all of the size classes in the 2008 sample showed decreases. The drop in quality size fish (7 inches or larger) was most notable and we did not see any of the trophy size we observed in 2005. It is apparent that the drought conditions between

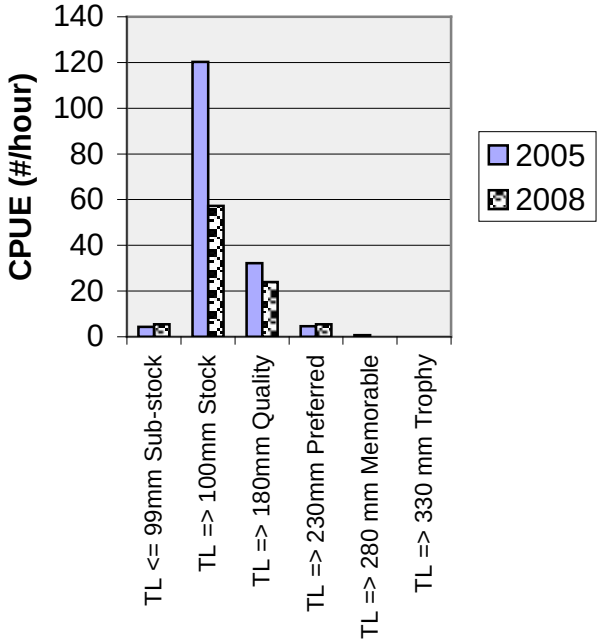
2005 and 2008 have had a more dramatic effect on rock bass than smallmouth bass. The dewatering of critical shoreline habitat is most likely the cause for this observed decline.

Figure 19. Length frequency distributions for rock bass collected in Little River from 2005 to 2008.



Relative stock density (RSD) analysis indicated the RSD for preferred rock bass (TL $\geq$ 230 mm) was 9.7. This was up considerably from the value recorded in 2005. RSD for both memorable (TL $\geq$ 280 mm) and trophy (TL $\geq$ 330 mm) size rock bass was 0. The PSD (ratio of quality size to stock size) of rock bass was 41.7. Catch by RSD category illustrated the most dramatic declines occurred in the RSD-stock category where the value dropped more than half in 2008 (Figure 20). Both the sub-stock and preferred categories showed slight increases over the 2005 values.

Figure 20. Relative stock density (RSD) catch per unit effort for rock bass collected in Little River from 2005 to 2008.



Like smallmouth bass, we did not take any otoliths from rock bass collected in Little River. Future surveys of this river should include a sub-sample of otoliths from this species in order to evaluate the age and growth characteristics of the population.

Collaborative community assessments of Little River have been ongoing since the 1980's. These surveys have primarily focused on evaluating relative health changes in the fish community. Two Index of Biotic Integrity surveys were conducted in July 2008, one at Coulters Bridge (river mile 20) and one at Townsend (river mile 29.8). A total of 50 fish species were collected at the Coulters Bridge site while 32 were observed at Townsend. Overall, the IBI analysis indicated the fish community was in excellent condition at Coulters Bridge (IBI score 58). The condition of the fish community remained the same as observed in 2007 at the upper most station, Townsend, receiving a rating of good to excellent (56, Figure 21). Several rare or endangered species of fish inhabit Little River, and thus, the protection of the watershed is a high priority of managing agencies and local conservation groups. Table 7 lists the species and number of fish collected at the two IBI stations.

Figure 21. Trends in the Index of Biotic Integrity (IBI) at two stations in Little River (1987-2008).

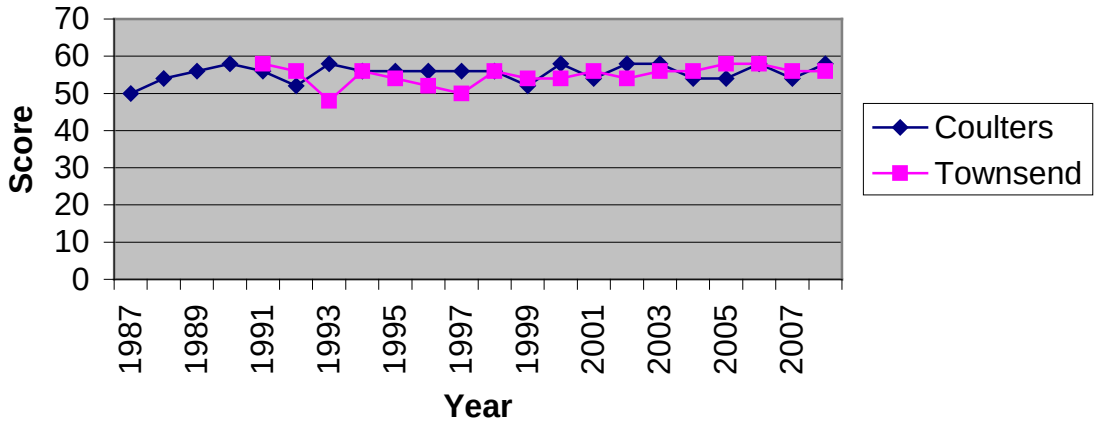


Table 7. Fish species collected at two Little River IBI stations 2008.

Site	Species	Number Collected
420080316 (Coulters Bridge)	*Ambloplites rupestris*	38
420080316 (Coulters Bridge)	*Ameiurus natalis*	2
420080316 (Coulters Bridge)	*Campostoma oligolepis*	75
420080316 (Coulters Bridge)	*Cottus carolinae*	14
420080316 (Coulters Bridge)	*Cyprinella galactura*	54
420080316 (Coulters Bridge)	*Cyprinella spiloptera*	40
420080316 (Coulters Bridge)	*Cyprinus carpio*	1
420080316 (Coulters Bridge)	*Dorosoma cepedianum*	6
420080316 (Coulters Bridge)	*Erimystax insignis*	8
420080316 (Coulters Bridge)	*Etheostoma blennioides*	24
420080316 (Coulters Bridge)	*Etheostoma camurum*	2
420080316 (Coulters Bridge)	*Etheostoma jessiae*	32
420080316 (Coulters Bridge)	*Etheostoma rufilineatum*	491
420080316 (Coulters Bridge)	*Etheostoma tennesseense*	28
420080316 (Coulters Bridge)	*Etheostoma vulneratum*	1
420080316 (Coulters Bridge)	*Etheostoma zonale*	24
420080316 (Coulters Bridge)	*Fundulus catenatus*	10
420080316 (Coulters Bridge)	*Hybopsis amblops*	130
420080316 (Coulters Bridge)	*Hypentelium nigricans*	23
420080316 (Coulters Bridge)	*Lampetra appendix*	1
420080316 (Coulters Bridge)	*Lepisosteus osseus*	5
420080316 (Coulters Bridge)	*Lepomis auritus*	94
420080316 (Coulters Bridge)	*Lepomis cyanellus*	5
420080316 (Coulters Bridge)	*Lepomis macrochirus*	27
420080316 (Coulters Bridge)	*Lepomis microlophus*	1
420080316 (Coulters Bridge)	*Luxilus chrysocephalus*	23
420080316 (Coulters Bridge)	*Luxilus coccogenis*	35
420080316 (Coulters Bridge)	*Lythrurus lirus*	3
420080316 (Coulters Bridge)	*Micropterus dolomieu*	10
420080316 (Coulters Bridge)	*Micropterus punctulatus*	6
420080316 (Coulters Bridge)	*Micropterus salmoides*	2
420080316 (Coulters Bridge)	*Minytrema melanops*	2
420080316 (Coulters Bridge)	*Moxostoma anisurum*	5
420080316 (Coulters Bridge)	*Moxostoma carinatum*	8
420080316 (Coulters Bridge)	*Moxostoma duquesneii*	101
420080316 (Coulters Bridge)	*Moxostoma erythrurum*	42
420080316 (Coulters Bridge)	*Nocomis micropogon*	24
420080316 (Coulters Bridge)	*Notropis leuciodus*	100
420080316 (Coulters Bridge)	*Notropis micropteryx*	106
420080316 (Coulters Bridge)	*Notropis photogenis*	6
420080316 (Coulters Bridge)	*Notropis telescopus*	55
420080316 (Coulters Bridge)	*Notropis volucellus*	21
420080316 (Coulters Bridge)	*Noturus eleutherus*	1
420080316 (Coulters Bridge)	*Oncorhynchus mykiss*	1
420080316 (Coulters Bridge)	*Percina aurantiaca*	4
420080316 (Coulters Bridge)	*Percina caprodes*	4
420080316 (Coulters Bridge)	*Percina evides*	15
420080316 (Coulters Bridge)	*Percina williamsi*	2
420080316 (Coulters Bridge)	*Phenacobius uranops*	4
420080316 (Coulters Bridge)	*Pylodictis olivaris*	1
420080317 (Townsend)	*Ambloplites rupestris*	74
420080317 (Townsend)	*Campostoma oligolepis*	74
420080317 (Townsend)	*Cottus carolinae*	57
420080317 (Townsend)	*Cyprinella galactura*	57
420080317 (Townsend)	*Erimystax insignis*	19
420080317 (Townsend)	*Etheostoma blennioides*	22

Table 7. Continued.

Site	Species	Number Collected
420080317 (Townsend)	*Etheostoma rufilineatum*	148
420080317 (Townsend)	*Etheostoma tennesseense*	49
420080317 (Townsend)	*Etheostoma zonale*	36
420080317 (Townsend)	*Fundulus catenatus*	21
420080317 (Townsend)	*Hybopsis amblops*	40
420080317 (Townsend)	*Hypentelium nigricans*	34
420080317 (Townsend)	*Ichthyomyzon greeleyi*	5
420080317 (Townsend)	*Lampetra appendix*	7
420080317 (Townsend)	*Lepomis auritus*	2
420080317 (Townsend)	*Lepomis cyanellus*	2
420080317 (Townsend)	*Lepomis macrochirus*	6
420080317 (Townsend)	*Luxilus chrysocephalus*	10
420080317 (Townsend)	*Luxilus coccogenis*	62
420080317 (Townsend)	*Lythrurus lirus*	8
420080317 (Townsend)	*Micropterus dolomieu*	9
420080317 (Townsend)	*Moxostoma duquesneii*	20
420080317 (Townsend)	*Moxostoma erythrurum*	1
420080317 (Townsend)	*Nocomis micropogon*	50
420080317 (Townsend)	*Notropis leuciodus*	205
420080317 (Townsend)	*Notropis micropteryx*	10
420080317 (Townsend)	*Notropis photogenis*	10
420080317 (Townsend)	*Notropis telescopus*	198
420080317 (Townsend)	*Notropis volucellus*	20
420080317 (Townsend)	*Percina burtoni*	3
420080317 (Townsend)	*Percina evides*	6
420080317 (Townsend)	*Phenacobius uranops*	1

Benthic macroinvertebrates collected in our sample at Townsend comprised 34 families representing 42 identified genera (Table 8). The most abundant group in our collection was the mayflies comprising 32% of the total sample. Overall, a total of 51 taxa were identified from the sample of which 17 were EPT. Based on the EPT taxa richness and overall biotic index of all species collected, the relative health of the benthic community was classified as "Fair to Good" (3.0).

Table 8. Taxa list and associated biotic statistics for benthic macroinvertebrates collected from Little River at Townsend 2008.

ORDER	FAMILY	SPECIES	NUMBER	PERCENT
ANNELIDA				1.0
	Oligochaeta		2	
COLEOPTERA				22.7
	Dryopidae	*Helichus* adults	6	
	Elmidae	*Ancyronyx variegatus* larvae	2	
		Dubiraphia larva and adults	5	
		Macronychus glabratus adults and larva	14	
		Microcylloepus pusillus adult	1	
		Optioservus larva	1	
		Optioservus trivittatus adults	2	
		Promoresia elegans larvae and adults	7	
	Gyrinidae	*Dineutus discolor* males	2	
	Psephenidae	*Psephenus herricki* larvae and adult	6	
DIPTERA				12.8
	Athericidae	*Atherix lantha*	6	
	Ceratopogonidae	*Atrichopogon*	1	
	Chironomidae		16	
	Dixidae	*Dixella*	1	
	Simuliidae		1	
	Tanyderidae	*Protoplasa fitchii*	1	

Table 8. Continued.

EPHEMEROPTERA				32.0
	Baetidae	*Baetis*	12	
	Caenidae	*Caenis*	1	
	Ephemerellidae	*Serratella*	3	
	Heptageniidae	*Heptagenia*	3	
		Leucrocuta	2	
		Maccaffertium early instars	9	
		Maccaffertium mediopunctatum	3	
		Stenacron interpunctatum	2	
		Stenacron pallidum	4	
	Isonychiidae	*Isonychia*	16	
	Leptohyphidae	*Tricorythodes*	9	
	Neoephemeridae	*Neoephemera pupurea*	1	
GASTROPODA				4.4
	Physidae		1	
	Pleuroceridae	*Leptoxis*	3	
		Pleurocera striped form	3	
		Pleurocera yellow form	2	
				0.5
HETEROPTERA	Veliidae	*Rhagovelia* nymph	1	
HYDRACARINA			1	0.5
MEGALOPTERA				3.4
	Corydalidae	*Corydalus cornutus*	5	
		Nigronia serricornis	1	
	Sialidae	*Sialis*	1	
ODONATA				7.9
	Aeshnidae	*Basiaeschna janata*	1	
		Boyeria vinosa	6	
	Coenagrionidae	*Argia*	2	
	Gomphidae	*Dromogomphus spinosus*	1	
		Hagenius brevistylus	1	
		Lanthus vernalis	3	
	Macromiidae	*Macromia*	2	
PELECYPODA				3.4
	Corbiculidae	*Corbicula fluminea*	4	
	Sphaeriidae		3	
PLECOPTERA				1.5
	Pteronarcyidae	*Pteronarcys dorsata*	3	
TRICHOPTERA				9.9
	Brachycentridae	*Brachycentrus lateralis*	3	
	Hydropsychidae	*Cheumatopsyche*	4	
	Leptoceridae	*Triaenodes* early instars prob. *perna*	2	
		Triaenodes ignitus	7	
	Polycentropodidae	*Polycentropus*	4	
		Total	**203**	

TAXA RICHNESS = 51
EPT TAXA RICHNESS = 17
BIOCLASSIFICATION = 3.0 (FAIR/GOOD)

Benthic macroinvertebrates collected in our sample at Coulters Bridge comprised 35 families representing 45 identified genera (Table 9). The most abundant group in our collection was the mayflies comprising 27.7% of the total sample. Overall, a total of 51 taxa were identified from the sample of which 16 were EPT. Based on the EPT taxa richness and overall biotic index of all species collected, the relative health of the benthic community was classified as “Fair/Good to Good” (3.8).

Table 9. Taxa list and associated biotic statistics for benthic macroinvertebrates collected from Little River at Coulters Bridge 2008.

ORDER	FAMILY	SPECIES	NUMBER	PERCENT
ANNELIDA				3.2
	Oligochaeta		8	
COLEOPTERA				23.3
	Dryopidae	*Helichus* adults	7	
	Elmidae	*Dubiraphia* adults	2	
		Macronychus glabratus adult	9	
		Optioservus trivittatus adults	7	
		Promoresia elegans adults and larvae	17	
		Stenelmis adult	1	
	Gyrinidae	*Dineutus discolor* male and female	2	
	Hydrophilidae	*Paracymus*	1	
		Tropisternus natator	5	
	Psephenidae	*Psephenus herricki* larvae	8	
DIPTERA				13.4
	Athericidae	*Atherix lantha*	2	
	Chironomidae		28	
	Culicidae		1	
	Simuliidae		3	
EPHEMEROPTERA				27.7
	Baetidae	*Baetis*	10	
	Caenidae	*Caenis*	2	
	Ephemerellidae	*Serratella*	6	
	Heptageniidae	*Heptagenia*	1	
		Maccaffertium early instars	14	
		Maccaffertium mediopunctatum	7	
		Stenacron interpunctatum	1	
	Isonychiidae	*Isonychia*	25	
	Leptohyphidae	*Tricorythodes*	4	
GASTROPODA				3.6
	Physidae		2	
	Pleuroceridae	*Leptoxis*	3	
		Pleurocera	4	
HETEROPTERA				2.8
	Belostomatidae	*Abedus/Belostoma* nymph	1	
		Belostoma flumineum	1	
	Gerridae	*Metrobates hesperius*	2	
	Nepidae	*Ranatra* nymph	1	
	Veliidae	*Rhagovelia obesa* male and female	2	
HYDRACARINA			2	0.8
MEGALOPTERA				5.5
	Corydalidae	*Corydalus cornutus*	5	
		Nigronia serricornis	1	
	Sialidae	*Sialis*	8	
ODONATA				5.9
	Aeshnidae	*Boyeria vinosa*	1	
	Calopterygidae	*Hetaerina americana*	3	
	Coenagrionidae	*Argia*	2	
	Gomphidae	*Dromogomphus spinosus*	3	
		Gomphus lividus	1	
		Hagenius brevistylus	2	
	Macromiidae	*Macromia*	3	
PELECYPODA				0.8
	Corbiculidae	*Corbicula fluminea*	2	
PLECOPTERA				0.4
	Perlidae	*Acroneuria abnormis*	1	
TRICHOPTERA				10.3
	Brachycentridae	*Brachycentrus lateralis*	5	
	Hydropsychidae	*Ceratopsyche morosa*	2	
		Cheumatopsyche	12	
		Hydropsyche venularis	3	
	Lepteroceridae	*Oecetis*	1	
		Triaenodes perna	1	
	Polycentropodidae	*Polycentropus*	2	
TURBELLARIA			6	2.4
		Total	**253**	

TAXA RICHNESS = 51
EPT TAXA RICHNESS = 16
BIOCLASSIFICATION = (3.8) FAIR/GOOD-GOOD

Discussion

Little River provides anglers with the opportunity to catch all species of black bass along with rock bass. Because of the low numbers of spotted and largemouth bass in Little River, it should not be considered a viable sport fishery for these species.

The river represents an outstanding resource in the quality of the water and the species that inhabit it. With the growing development in the watershed it will be imperative to monitor activities such that mitigation measures can be taken to ensure that the river maintains its outstanding water quality and aesthetic value. Continued efforts by the watershed group will continue to play an important role in the management of the watershed and serve as a "watchdog" for unregulated activities.

Trout stocking during suitable months is very popular for residents and non-residents visiting the area. This program should continue at the current level unless use dictates the need for program expansion.

TWRA should continue to be involved with the cooperative community assessment surveys each year. These are important indicators of the health of one of the regions best streams and serves as a benchmark in evaluating other streams of similar size and character. Effective March 1, 2009, smallmouth bass regulations in Little River from Rockford Dam upstream to the Great Smoky Mountains National Park boundary will protect bass 13 to 17 inches in length. One fish of the five fish daily creek limit can exceed 17 inches. Sport fishery surveys on Little River will be conducted on a three-year rotation in order to assess any changes in the fishery. Our return trip in 2011 to look at the sport fish will in all likelihood focus on the sample sites surveyed in 2008, providing no new or more efficient sampling scheme is developed.

Management Recommendations

1. Initiate an angler use and harvest survey.

2. Develop a fishery management plan for the river.

3. Cooperate with the local watershed organization to protect and enhance the river and its tributaries.

Pigeon River

Introduction

The Pigeon River has had a long history of pollution problems, stemming primarily from the 80 plus-year discharge of wastewater from the Champion Paper Mill in Canton, North Carolina. This discharge has undoubtedly had a profound effect on the recreational use of the river and after the discovery of elevated dioxin levels in the 1980's raised concerns about public health (TDEC 1996). Although the river has received increased attention in recent years, the recreational use of the river has not developed its full potential. In terms of the fishery, consumption of all fish was prohibited up until 1996 when the ordinance was downgraded, limiting consumption of carp, catfish, and redbreast sunfish (TDEC 1996). In 2003, all consumption advisories were removed from the river. Since 1988, inter-agency Index of Biotic Integrity samples have been conducted at two localities, one near river mile 8.2 (Tannery Island) and one at river mile 16.6 (Denton).

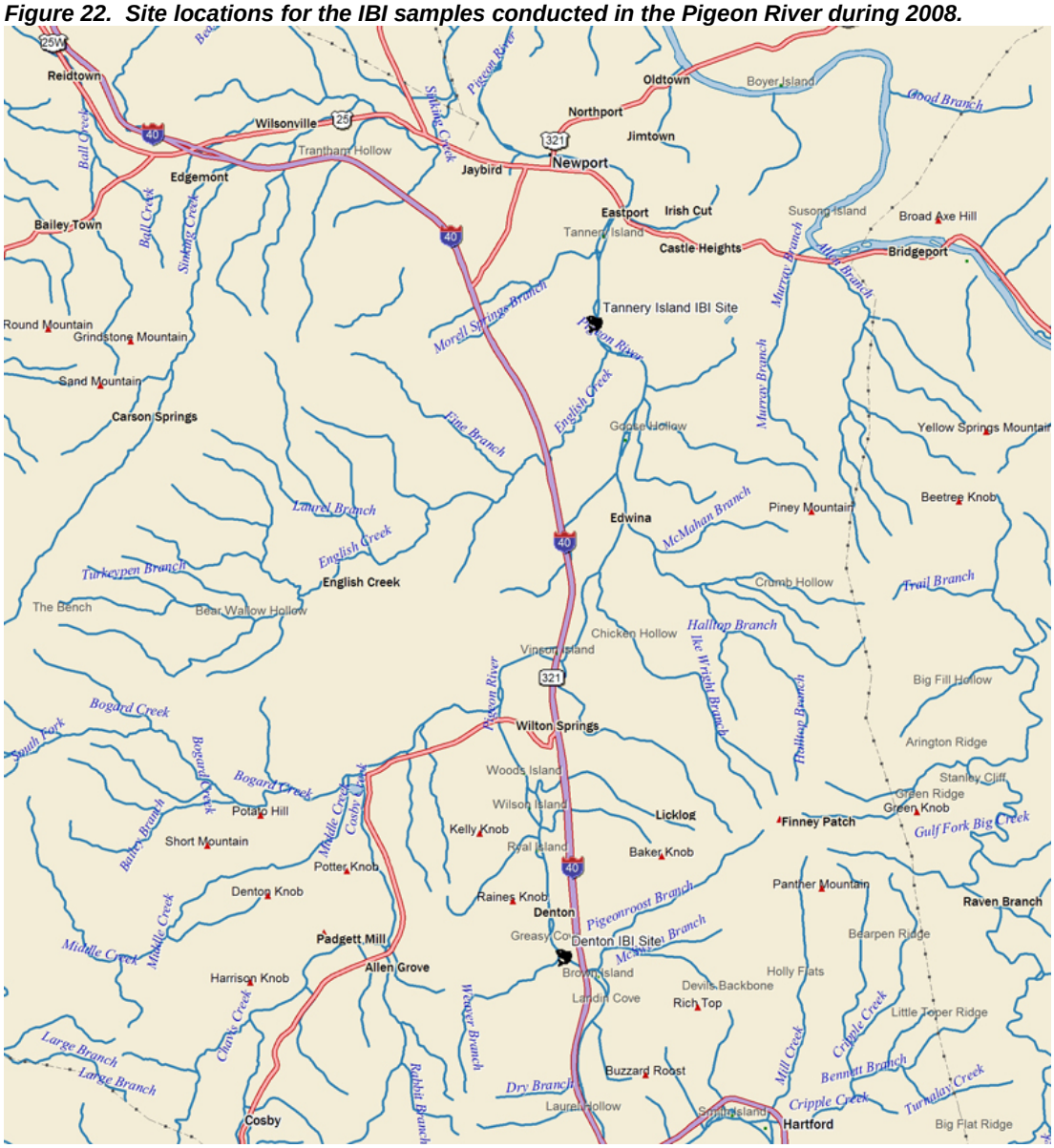
Our 2008 surveys focused on continuing to evaluate the fish community at two long-term IBI stations. Catch effort data along with otolith samples from rock bass and black bass were collected from three sites in 1997 (Bivens et al. 1998) and five sites in 1998 (Carter et al. 1999). Since 1999, data has been collected at five to six sites between river mile 4.0 and 20.5 (Carter et al. 2000-2007). During 1998, a 508 mm minimum (20-inch) length limit on smallmouth bass with a one fish possession limit was passed by the Tennessee Wildlife Resources Commission (TWRC). This regulation was implemented on March 1, 1999.

Study Area and Methods

The Pigeon River originates in North Carolina and flows in a northwesterly direction before emptying into the French Broad River near river mile 73.8. The river has a drainage area of approximately 1,784 km^2 at its confluence with the French Broad River. In Tennessee, approximately 35 kilometers of the Pigeon River flows through mountainous terrain with interspersed communities and small farms before joining the French Broad River near Newport. Public access along the river is primarily limited to bridge crossings and small "pull-outs" along roads paralleling the river. There are a few primitive launching areas for canoes or small boats and one moderately developed launch at Denton. On July 9 and 10, 2008, we conducted IBI fish surveys at Tannery Island (PRM 8.2) and Denton (PRM 16.6) (Figure 22).

Rafting on the Pigeon River is a Popular Summer Activity

Figure 22. Site locations for the IBI samples conducted in the Pigeon River during 2008.



Fish were collected according to the IBI criteria described in the methods section of this report. Both backpack and boat electrofishing were used to collect samples from both stations. Qualitative benthic macroinvertebrates were collected at both stations and analyzed to produce a biotic index score similar to those derived for the fish IBI.

Results

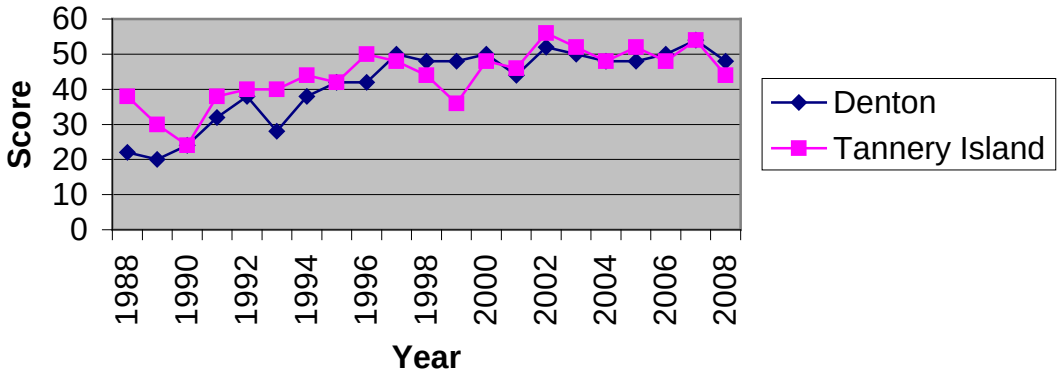
Collaborative community assessments of Pigeon River have been ongoing since the late 1980's. These surveys have primarily focused on evaluating relative health changes in the fish community. A total of 42 fish species were collected at the Tannery Island site while 33 were observed at Denton (Table 10). Overall, The IBI analysis indicated the fish community was in fair condition at Tannery Island (IBI score 44). The condition of the fish community assessed slightly higher at the Denton site scoring 48 (Good). Both scores were lower

when compared to the previous year's analysis. The score at Tannery Island decreased 10 points from the 2007 score while the score at Denton decreased six points (Figure 23).

Table 10. Fish species collected at the two Pigeon River IBI stations during 2008.

Pigeon River Mile	8.2 (Tannery Island)	Number Collected	16.6 (Denton)	Number Collected
	420080601		420080603	
	Ambloplites rupestris	20	*Ambloplites rupestris*	30
	Aplodinotus grunniens	2	*Ameiurus melas*	1
	Campostoma oligolepis	346	*Ameiurus natalis*	4
	Carpiodes carpio	1	*Campostoma oligolepis*	273
	Cottus carolinae	27	*Cottus carolinae*	108
	Cyprinella galactura	48	*Cyprinella galactura*	267
	Cyprinella spiloptera	65	*Dorosoma cepedianum*	28
	Cyprinus carpio	2	*Etheostoma blennioides*	32
	Dorosoma cepedianum	89	*Etheostoma rufilineatum*	465
	Dorosoma petenense	3	*Etheostoma tennesseense*	56
	Etheostoma blennioides	240	*Etheostoma swannanoa*	1
	Etheostoma kennicotti	3	*Hybopsis amblops*	37
	Etheostoma rufilineatum	489	*Hybrid Lepomis spp.*	1
	Etheostoma tennesseense	94	*Hypentelium nigricans*	43
	Etheostoma zonale	1	*Ichthyomyzon bdellium*	5
	Gambusia affinis	1	*Ictalurus punctatus*	4
	Hybopsis amblops	5	*Ictiobus bubalus*	6
	Hybrid lepomis spp.	4	*Ictiobus niger*	5
	Hypentelium nigricans	75	*Lepomis auritus*	14
	Ichthyomyzon bdellium	1	*Lepomis cyanellus*	1
	Ictalurus punctatus	11	*Lepomis macrochirus*	6
	Ictiobus bubalus	10	*Micropterus dolomieu*	43
	Ictiobus niger	13	*Moxostoma anisurum*	1
	Lepomis auritus	215	*Moxostoma breviceps*	2
	Lepomis macrochirus	14	*Moxostoma carinatum*	3
	Micropterus dolomieu	32	*Moxostoma duquesneii*	24
	Micropterus salmoides	9	*Moxostoma erythrurum*	4
	Moxostoma anisurum	4	*Notropis photogenis*	116
	Moxostoma breviceps	5	*Notropis telescopus*	6
	Moxostoma carinatum	1	*Oncorhynchus mykiss*	1
	Moxostoma duquesneii	24	*Percina evides*	10
	Moxostoma erythrurum	8	*Rhinichthys cataractae*	1
	Nocomis micropogon	2	*Sander vitreum*	1
	Notropis micropteryx	34		
	Notropis photogenis	11		
	Notropis telescopus	2		
	Noturus eleutherus	3		
	Percina caprodes	35		
	Percina evides	1		
	Pimephales vigilax	1		
	Pylodictis olivaris	1		
	Sander vitreum	2		

Figure 23. Trends in Index of Biotic Integrity (IBI) at two stations on the Pigeon River (1988-2008).



Benthic macroinvertebrates collected at the Tannery Island site comprised 30 families representing 30 identified genera (Table 11). The most abundant group in our collection was the caddisflies comprising 52.7% of the total sample. Overall, a total of 39 taxa were identified from the sample of which 6 were EPT. Based on the EPT taxa richness and overall biotic index of all species collected, the relative health of the benthic community was classified as "Fair" (2.0).

Table 11 . Taxa list and associated biotic statistics for benthic macroinvertebrates collected from the Pigeon River at Tannery Island (river mile 8.2) 2008.

ORDER	FAMILY	SPECIES	NUMBER	PERCENT
AMPHIPODA				0.7
	Crangonyctidae	*Crongonyx/Synurella*	2	
ANNELIDA				7.4
	Hirudinea		4	
	Oligochaeta		18	
COLEOPTERA				4.0
	Elmidae	*Ancyronyx variegatus* adults	3	
		Macronychus glabratus larva and adults	3	
		Microcylloepus pusillus adults	2	
		Promoresia elegans larva and adult	2	
	Gyrinidae	*Dineutus discolor* female	1	
	Hydrophilidae	*Tropisternus natator* adult	1	
DIPTERA				6.7
	Chironomidae		15	
	Simuliidae		3	
	Tipulidae	*Tipula*	2	
EPHEMEROPTERA				2.7
	Baetidae	*Baetis*	3	
	Heptageniidae	*Maccaffertium mediopunctatum*	5	
GASTROPODA				5.7
	Ancylidae	*Ferrissia*	4	
	Physidae		3	
	Planorbidae		2	
	Pleuroceridae	*Leptoxis*	1	
		Pleurocera striped form	3	
		Pleurocera yellow form	4	
HETEROPTERA				1.0
	Belostomatidae	*Belostoma flumineum*	1	
	Corixidae		1	
	Veliidae	*Rhagovelia* nymph	1	
ISOPODA				2.3
	Asellidae	*Caecidotea*	7	
MEGALOPTERA				4.7
	Corydalidae	*Corydalus cornutus*	14	
ODONATA				11.1
	Aeshnidae	*Basiaeschna janata*	1	
		Boyeria vinosa	7	
	Calopterygidae	*Hetaerina americana*	5	
	Coenagrionidae	*Argia*	11	
		Enallagma	6	
		Ischnura hastata	1	
	Gomphidae	*Hagenius brevistylus*	1	
	Macromiidae	*Macromia*	1	
PELECYPODA				1.0
	Corbiculidae	*Corbicula fluminea*	2	
	Sphaeriidae		1	
TRICHOPTERA				52.7
	Brachycentridae	*Brachycentrus lateralis*	3	
	Hydropsychidae	*Ceratopsyche morosa larvae and pupae*	65	
		Cheumatopsyche	86	
	Leptoceridae	*Triaenodes ignitus*	3	
		Total	**298**	

TAXA RICHNESS = 39
EPT TAXA RICHNESS = 6
BIOCLASSIFICATION = 2.0 (FAIR)

Benthic macroinvertebrates collected at the Denton site comprised 31 families representing 33 identified genera (Table 12). The most abundant group in our collection was the mayflies comprising 41.6% of the total sample. Overall,

a total of 42 taxa were identified from the sample of which 14 were EPT. Based on the EPT taxa richness and overall biotic index of all species collected, the relative health of the benthic community was classified as “Fair/Good” (3.0).

Table 12. Taxa list and associated biotic statistics for benthic macroinvertebrates collected from the Pigeon River at Denton (river mile 16.6).

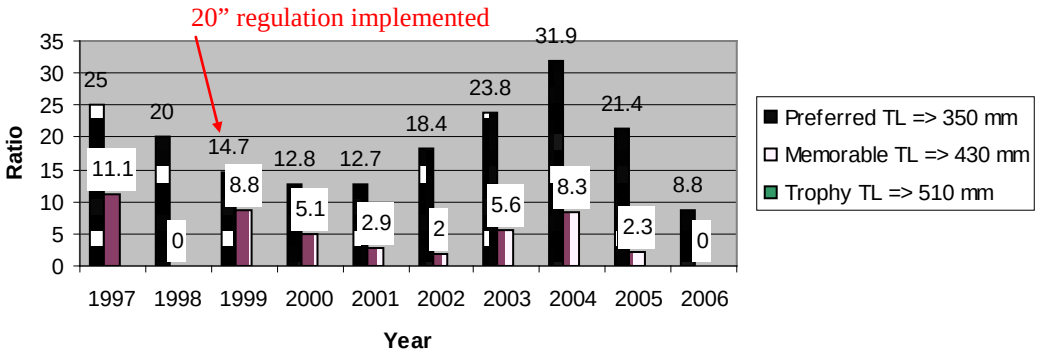
ORDER	FAMILY	SPECIES	NUMBER	PERCENT
AMPHIPODA				0.3
	Crangonyctidae	*Crangonyx/Synurella*	2	
ANNELIDA				1.6
	Oligochaeta		10	
COLEOPTERA				4.5
	Dryopidae	*Helichus* adults	3	
	Elmidae	*Macronychus glabratus* adult	1	
		Microcylloepus puscillus adults and larvae	11	
		Optioservus ovalis adults	2	
		Promoresia elegans larva	1	
	Gyrinidae	*Dineutus discolor* adult females	2	
		Dineutus discolor larvae	4	
	Hydrophilidae	*Cymbiodyta*	2	
	Psephenidae	*Psephenus herricki* larvae	2	
DIPTERA				6.7
	Athericidae	*Atherix lantha*	1	
	Chironomidae		27	
	Simuliidae		10	
	Tipulidae	*Antocha*	4	
EPHEMEROPTERA				41.6
	Baetidae	*Baetis*	42	
	Ephemerellidae	*Serratella*	9	
	Heptageniidae	*Maccaffertium* early instars	27	
		Maccaffertium ithaca	16	
		Maccaffertium mediopunctatum	3	
		Maccaffertium modestum	1	
	Isonychiidae	*Isonychia*	162	
GASTROPODA				0.6
	Planorbidae		1	
	Pleuroceridae	*Leptoxis* large specimens	3	
HETEROPTERA				0.5
	Veliidae	*Rhagovelia obesa* adults	3	
HYDRACARINA			1	0.2
ISOPODA				0.3
	Asellidae	*Caecidotea*	2	
MEGALOPTERA				2.6
	Corydalidae	*Corydalus cornutus*	9	
		Nigronia serricornis	6	
	Sialidae	*Sialis*	1	
ODONATA				1.9
	Aeshnidae	*Boyeria vinosa*	1	
	Coenagrionidae	*Argia*	4	
	Corduliidae	*Neurocordulia yamaskanensis*	1	
	Gomphidae	*Lanthus vernalis*	1	
	Macromiidae	*Macromia*	5	
PELECYPODA				1.3
	Corbiculidae	*Corbicula fluminea*	8	
PLECOPTERA				0.6
	Perlidae	*Acroneuria abnormis*	4	
TRICHOPTERA				37.3
	Brachycentridae	*Brachycentrus lateralis*	15	
	Hydropsychidae	*Ceratopsyche morosa*	109	
		Ceratopsyche sparna	3	
		Cheumatopsyche	96	
		Hydropsyche franclemonti	8	
		Hydropsyche venularis	1	
	Polycentropodidae	*Polycentropus*	1	
		Total	**625**	

TAXA RICHNESS = 42
EPT TAXA RICHNESS = 14
BIOCLASSIFICATION = FAIR/GOOD (3.0)

Discussion

The Pigeon River provides anglers with the opportunity to catch all species of black bass as well as rock bass. Perhaps the greatest potential for elevating this river's "trophy" status lies in the smallmouth bass population. The last black bass and rock bass survey of the Pigeon was in 2006. The river was put into a rotational survey scheme after 2006 and will be sampled again in 2009. During 2006, we recorded the lowest percentage of preferred smallmouth bass to date (Figure 24). Overall, the value decreased 59% from the previous year and was 53% lower than the ten year average. There was no memorable size bass collected in 2006, which only occurred in one other instance (1998) during the ten year time period.

Figure 24. Trends in the ratio of preferred, memorable, and trophy smallmouth bass collected from the Pigeon River 1997-2006.



Water quality improvement over the last 20 years has primarily been the result of more advanced wastewater treatment at the Blue Ridge Paper Mill in Canton, North Carolina. The improved water quality has undoubtedly had an affect on the amount of recreation that is currently taking place, particularly whitewater rafting. It has also resulted in the return of a few species (e.g. silver shiner, telescope shiner) previously not encountered in the annual surveys and the implementation of a fish and mollusk recovery effort. During 2006, there were at least two instances of pesticides entering the river. During these events, both benthic invertebrates and fish were killed. Investigations by TWRA and TDEC resulted in identifying the areas of agricultural runoff into the river. A remediation plan to control the runoff of agricultural pesticides is being developed by TDEC and TWRA.

We will monitor black bass and rock bass populations in the Pigeon River during late September or October in order to increase our efficiency in characterizing the smallmouth bass populations in the river. Index of Biotic Integrity samples will continue on an annual basis.

Management Recommendations

1. Continue monitoring the sport fish population every three years.

2. Continue the cooperative IBI surveys at the two established stations (Denton and Tannery Island).

3. Develop a management plan for the river.

4. Continue cooperative efforts to reintroduce common species.

5. Closely monitor black fly control program being conducted by the University of Tennessee.

6. Consider developing a put and take or delayed harvest trout stocking program in the upper reach of the river (mile 16 and above).

Summary

During 2008, we surveyed three rivers collecting 30 fish samples and four benthic samples. These included the Clinch River, Powell River, and Little River. Cooperative Index of Biotic Integrity surveys were conducted in Little River and the Pigeon River. Overall, CPUE estimates for black bass and rock bass looked relatively good despite the ongoing drought. We did observe some substantial declines in the rock bass catch in Little River. The value there was reduced by over half of the value observed in 2005. The extremely low water and dewatering of habitat in this river is believed to be the reason for the observed declines. The USGS recorded the lowest flow for the river in 2007 since the agency began record keeping for the river in 1951.

The IBI surveys for Little River and the Pigeon River fluctuated somewhat when compared to the previous year. The Pigeon River lost ten points at the lower station receiving a "fair" classification, while the station at Denton dropped six points resulting in a classification of "good". In Little River, the index at the Coulters Bridge site increase slightly from 2007 and was classified as "excellent". The score for the Townsend site remained unchanged from the classification of "good to excellent" assigned to the site in 2007. Fish reintroductions continued on the Pigeon River with many of the introduced species collected in the 2008 IBI samples. The identification and evaluation of the fish kills above Tannery Island prompted more regulatory action for 2007 by TDEC and TWRA. Benthic macroinvertebrate trends in Little River and the Pigeon River generally took a down turn in 2008. With the exception of the Coulters Bridge site on Little River, all other sites sampled in 2008 showed decreases in the overall biotic index score. The most dramatic decline was observed at the Pigeon River Tannery Island site where the score dropped 1.7 points from 2007.

Over the past 15 years the stream survey unit has been conducting Index of Biotic Integrity surveys in various watersheds within the region. These have been done in response to requests made by TWRA personnel, cooperative effort requests, and general interest in determining the state of certain streams. Our compilation of these surveys has given us a reference database for many streams in the region that can be used for comparison purposes should we return for a routine survey or responding to a water quality issue. Table 13 lists our results for various streams surveyed during this time period.

Table 13. Index of Biotic Integrity and Benthic Biotic Index scores for samples conducted between 1994 and 2008.

Water	Watershed	Year Surveyed	County	IBI Score	Benthic BI Score
Capuchin Creek	Cumberland River	1994	Campbell	44 (Fair)	3 (Fair/Good)
Trammel Branch	Cumberland River	1994	Campbell	36 (Poor/Fair)	3 (Fair/Good)
Hatfield Creek	Cumberland River	1994	Campbell	42 (Fair)	3 (Fair/Good)
Baird Creek	Cumberland River	1994	Campbell	38 (Poor/Fair)	3 (Fair/Good)
Clear Fork (Site 1)	Cumberland River	1994	Campbell	52 (Good)	3 (Fair/Good)
Clear Fork (Site 2)	Cumberland River	1994	Claiborne	40 (Fair)	N/A
Clear Fork (Site 3)	Cumberland River	1994	Claiborne	24 (Very Poor/Poor)	1 (Poor)
Elk Fork Creek	Clear Fork	1994	Campbell	40 (Fair)	2 (Fair)
Fall Branch	Clear Fork	1994	Campbell	28 (Poor)	1 (Poor)
Crooked Creek	Clear Fork	1994	Campbell	38 (Poor/Fair)	2 (Fair)
Burnt Pone Creek	Clear Fork	1994	Campbell	38 (Poor/Fair)	2 (Fair)
Whistle Creek	Clear Fork	1994	Campbell	38 (Poor/Fair)	2 (Fair)

Table 13. Continued.

Water	Watershed	Year Surveyed	County	IBI Score	Benthic BI Score
Little Elk Creek	Clear Fork	1994	Campbell	40 (Fair)	2 (Fair)
Lick Fork	Clear Fork	1994	Campbell	38 (Poor/Fair)	2 (Fair)
Terry Creek	Clear Fork	1994	Campbell	48 (Good)	2 (Fair)
Crouches Creek	Clear Fork	1994	Campbell	28 (Poor)	1 (Poor)
Hickory Creek (Site 1)	Clear Fork	1994	Campbell	46 (Fair/Good)	3 (Fair/Good)
Hickory Creek (Site 2)	Clear Fork	1994	Campbell	48 (Good)	2 (Fair)
White Oak Creek	Clear Fork	1994	Campbell	30 (Poor)	2 (Fair)
No Business Branch	Clear Fork	1994	Campbell	30 (Poor)	3 (Fair/Good)
Laurel Fork	Clear Fork	1994	Campbell	52 (Good)	3 (Fair/Good)
Lick Creek	Clear Fork	1994	Campbell	44 (Fair)	3 (Fair/Good)
Davis Creek	Clear Fork	1994	Campbell	38 (Poor/Fair)	2 (Fair)
Rock Creek	Clear Fork	1994	Campbell	54 (Good/Excellent)	3 (Fair/Good)
Little Tackett Creek	Clear Fork	1994	Claiborne	28 (Poor)	3 (Fair/Good)
Unnamed tributary to Little Tackett Creek	Clear Fork	1994	Claiborne	0 (No Fish)	3 (Fair/Good)
Rose Creek	Clear Fork	1994	Campbell	36 (Poor/Fair)	2 (Fair)
Rock Creek	Clear Fork	1994	Claiborne	28 (Poor)	2 (Fair)
Tracy Branch	Clear Fork	1994	Claiborne	34 (Poor)	2 (Fair)
Little Yellow Creek (Site 1)	Cumberland River	1994	Claiborne	38 (Poor/Fair)	N/A
Little Yellow Creek (Site 2)	Cumberland River	1994	Claiborne	38 (Poor/Fair)	N/A
Little Yellow Creek (Site 3)	Cumberland River	1994	Claiborne	36 (Poor/Fair)	N/A
Hickory Creek	Clinch River	1995	Knox	46 (Fair/Good)	3 (Fair/Good)
White Creek	Clinch River	1995	Union	34 (Poor) (SC)	4 (Good)
Little Sycamore Creek	Clinch River	1995	Claiborne	40 (Fair)	4.5 (Good/Excel).
Big War Creek	Clinch River	1995	Hancock	50 (Good)	4 (Good)
North Fork Clinch River	Clinch River	1995	Hancock	46 (Fair/Good)	4 (Good)
Old Town Creek (Site 1)	Powell River	1995	Claiborne	40 (Fair)	4 (Good)
Old Town Creek (Site 2)	Powell River	1995	Claiborne	42 (Fair)	4 (Good)
Indian Creek	Powell River	1995	Claiborne	N/A	4 (Good)
Sweetwater Creek	Tennessee River	1995	Loudon	30 (Poor)	3 (Fair/Good)
Burnett Creek	French Broad River	1995	Knox	46 (Fair/Good)	3 (Fair/Good)
Jockey Creek	Nolichucky River	1995	Greene	34 (Poor)	3 (Fair/Good)
South Indian Creek (Sandy Bottoms)	Nolichucky River	1995	Unicoi	38 (Poor/Fair)	4 (Good)
South Indian Creek (Ernestville)	Nolichucky River	1995	Unicoi	44 (Fair)	4 (Good)
Spivey Creek	Nolichucky River	1995	Unicoi	54 (Good/Excellent)	4 (Good)
Little Flat Creek	Holston River	1995	Knox	42 (Fair)	3 (Fair/Good)
Beech Creek	Holston River	1995	Hawkins	48 (Good)	4 (Good)
Big Creek	Holston River	1995	Hawkins	46 (Fair/Good)	4 (Good)
Alexander Creek	Holston River	1995	Hawkins	34 (Poor)	4 (Good)
Thomas Creek	South Fork Holston River	1995	Sullivan	54 (Good/Excellent)	4 (Good)
Hinds Creek	Clinch River	1996	Anderson	36 (Poor/Fair)	3 (Fair/Good)
Cove Creek	Clinch River	1996	Campbell	28 (Poor)	3 (Fair/Good)
Titus Creek	Clinch River	1996	Campbell	42 (Fair)	3 (Fair/Good)
Cloyd Creek	Tennessee River	1996	Loudon	36 (Poor/Fair)	4 (Good)
Sinking Creek	Little Tennessee River	1996	Loudon	34 (Poor)	4 (Good)
Baker Creek	Little Tennessee River	1996	Loudon	26 (Very Poor/Poor)	3 (Fair/Good)
Little Baker Creek	Little Tennessee River	1996	Blount	38 (Poor/Fair)	4 (Good)
Ninemile Creek	Little Tennessee River	1996	Blount	24 (Very Poor/Poor)	4 (Good)
East Fork Little Pigeon River	French Broad River	1996	Sevier	36 (Poor/Fair)	3 (Fair/Good)
Dunn Creek	French Broad River	1996	Sevier	32 (Poor)	4 (Good)
Wilhite Creek	French Broad River	1996	Sevier	44 (Fair)	4 (Good)
Watauga River (above Watauga Res.)	Holston River	1996	Johnson	42 (Fair)	4 (Good)
Stony Fork	Big South Fork	1996	Campbell	38 (Poor/Fair)	4 (Good)
Bullett Creek	Hiwassee River	1997	Monroe	50 (Good)	4.5 (Good/Excel.)
Canoe Branch	Powell River	1997	Claiborne	26 (V Poor/Poor) (SC)	4.7 (Excellent)
Town Creek	Tennessee River	1997	Loudon	34 (Poor)	2 (Fair)
Bat Creek	Little Tennessee River	1997	Monroe	30 (Poor)	1.5 (Poor/Fair)
Island Creek	Little Tennessee River	1997	Monroe	40 (Fair)	4 (Good)
Little Pigeon River	French Broad River	1997	Sevier	40 (Fair)	2 (Fair)
West Prong Little Pigeon River	French Broad River	1997	Sevier	46 (Fair/Good)	2 (Fair)
Flat Creek	French Broad River	1997	Sevier	30 (Poor)	3.8 (Good)
Clear Creek	French Broad River	1997	Jefferson	34 (Poor)	2.2 (Fair)
Richland Creek	Nolichucky River	1997	Greene	30 (Poor)	2.3 (Fair)
Middle Creek	Nolichucky River	1997	Greene	34 (Poor)	4 (Good)
Sinking Creek	Pigeon River	1997	Cocke	30 (Poor)	3.8 (Good)
Chestuee Creek	Hiwassee River	1998	Monroe	28 (Poor)	2.5 (Fair/Fair -Good)
Fourmile Creek	Powell River	1998	Hancock	36 (Poor/Fair)	4.5 (Good/Excel.)
Martin Creek	Powell River	1998	Hancock	50 (Good)	4 (Good)
Big Creek	Tellico River	1998	Monroe	46 (Fair/Good)	4 (Good)
Oven Creek	Nolichucky River	1998	Cocke	40 (Fair)	2.9 (Fair/Good)
Cherokee Creek	Nolichucky River	1998	Washington	36 (Poor/Fair)	2.8 (Fair/Good)
Bennetts Fork	Cumblerland River	2000	Claiborne	30 (Poor)	3.5 (Fair/Good)

Table 13. Continued.

Water	Watershed	Year Surveyed	County	IBI Score	Benthic BI Score
Gulf Fork Big Creek	French Broad River	2001	Cocke	42 (Fair)	4.0 (Good)
Nolichucky River	French Broad River	2001	Unicoi	56 (Good/Excellent)	4.0 (Good)
North Fork Holston River	Holston River	2001	Hawkins	50 (Good)	4.5 (Good)
Stinking Creek	Cumberland River	2002	Campbell	42 (Fair)	4.5 (Good)
Straight Fork	Cumberland River	2002	Campbell	18 (Very Poor)	3.0 (Fair/Good)
Montgomery Fork	Cumberland River	2002	Campbell	48 (Good)	3.5 (Fair/Good)
Turkey Creek	Holston River	2003	Hamblen	34 (Poor)	1.5 (Poor)
Spring Creek	Holston River	2003	Hamblen	34 (Poor)	2.2 (Fair)
Cedar Creek	Holston River	2003	Hamblen	30 (Poor)	3.5 (Fair/Good)
Fall Creek	Holston River	2003	Hamblen	32 (Poor)	2.3 (Fair)
Holley Creek	Nolichucky River	2003	Greene	30 (Poor)	2.4 (Fair)
College Creek	Nolichucky River	2003	Greene	36 (Poor/Fair)	2.2 (Fair)
Kendrick Creek	South Fork Holston River	2004	Sullivan	34 (Poor)	3.8 (Fair/Good-Good)
Sinking Creek	South Fork Holston River	2004	Sullivan	32 (Poor)	3.8 (Fair/Good-Good)
Mud Creek	Nolichucky River	2004	Greene	46 (Fair/Good)	4.0 (Good)
New River (Site 1)	Big South Fork Cumberland River	2004	Anderson	30 (Poor)	4.2 (Good)
New River (Site 2)	Big South Fork Cumberland River	2004	Campbell	42 (Fair)	3.5 (Fair/Good)
Indian Fork	Big South Fork Cumberland River	2004	Anderson	41 (Fair)	3.8 (Fair/Good-Good)
Unnamed Tributary to Taylor Branch	Hiwassee River	2005	Bradley	48 (Good)	4.0 (Good)
Little River (Coulters Bridge)	Tennessee River	2005	Blount	54 (Good/Excellent)	-
Little River (Townsend)	Tennessee River	2005	Blount	48 (Good)	-
Williams Creek	Clinch River	2005	Grainger	42 (Fair)	4.3 (Good)
Beaver Creek (Site 1)	Holston River	2005	Jefferson	38 (Poor/Fair)	2.8 (Fair/Fair-Good)
Beaver Creek (Site 2)	Holston River	2005	Jefferson	30 (Poor)	3.2 (Fair/Good)
Doe Creek	Holston River	2005	Johnson	46 (Fair/Good)	4.0 (Good)
Gap Creek	Nolichucky River	2005	Greene	36 (Poor/Fair)	3.5 (Fair/Good)
Pigeon River (Tannery Island)	French Broad River	2005	Cocke	52 (Good)	2.8 (Fair/Fair-Good)
Pigeon River (Denton)	French Broad River	2005	Cocke	48 (Good)	3.8 (Fair-Good/Good)
Little River (Coulters Bridge)	Tennessee River	2006	Blount	58 (Excellent)	4.2 (Good)
Little River (Townsend)	Tennessee River	2006	Blount	58 (Excellent)	4.7 (Good-Excellent)
Pigeon River (Tannery Island)	French Broad River	2006	Cocke	48 (Good)	3.5 (Fair-Good)
Pigeon River (Denton)	French Broad River	2006	Cocke	50 (Good)	3.8 (Fair-Good/Good)
Pigeon River (Hwy. 73 Bridge)	French Broad River	2006	Cocke	-	3.8 (Fair-Good/Good)
Little River (Coulters Bridge)	Tennessee River	2007	Blount	54 (Good)	3.8 (Fair-Good/Good)
Little River (Townsend)	Tennessee River	2007	Blount	56 (Good/Excellent)	4.0 (Good)
Pigeon River (Tannery Island)	French Broad River	2007	Cocke	54 (Good)	3.7 (Fair-Good/Good)
Pigeon River (Denton)	French Broad River	2007	Cocke	54 (Good)	3.5 (Fair/Good)
Little River (Coulters Bridge)	Tennessee River	2008	Blount	58 (Excellent)	3.8 (Fair-Good/Good)
Little River (Townsend)	Tennessee River	2008	Blount	56 (Good/Excellent)	3.0 (Fair/Good)
Pigeon River (Tannery Island)	French Broad River	2008	Cocke	44 (Fair)	2.0 (Fair)
Pigeon River (Denton)	French Broad River	2008	Cocke	48 (Good)	3.0 (Fair/Good)

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APPENDIX A

Common and scientific names of fishes used in this report (Nelson et al. 2004)

Family	Common Name	Scientific Name
Catostomidae	River carpsucker	*Carpiodes carpio*
	Northern hog sucker	*Hypentelium nigricans*
	Smallmouth buffalo	*Ictiobus bubalus*
	Black buffalo	*Ictiobus niger*
	Spotted sucker	*Minytrema melanops*
	Silver redhorse	*Moxostoma anisurum*
	Smallmouth redhorse	*Moxostoma breviceps*
	River redhorse	*Moxostoma carinatum*
	Black redhorse	*Moxostoma duquesneii*
	Golden redhorse	*Moxostoma erythrurum*
Centrachidae	Rock bass	*Ambloplites rupestris*
	Redbreast sunfish	*Lepomis auritus*
	Green sunfish	*Lepomis cyanellus*
	Bluegill	*Lepomis macrochirus*
	Redear sunfish	*Lepomis microlophus*
	Smallmouth bass	*Micropterus dolomieu*
	Spotted bass	*Micropterus punctulatus*
	Largemouth bass	*Micropterus salmoides*
Clupeidae	Gizzard shad	*Dorosoma cepedianum*
	Threadfin shad	*Dorosoma pentenense*
Cottidae	Banded sculpin	*Cottus carolinae*
Cyprinidae	Largescale stoneroller	*Campostoma oligolepis*
	Whitetail shiner	*Cyprinella galactura*
	Spotfin shiner	*Cyprinella spiloptera*
	Carp	*Cyprinus carpio*
	Blotched chub	*Erimystax insignis*
	Bigeye chub	*Hybopsis amblops*
	Striped shiner	*Luxilus chrysocephalus*
	Warpaint shiner	*Luxilus coccogenis*
	Mountain shiner	*Lythrurus lirus*
	River chub	*Nocomis micropogon*
	Tennessee shiner	*Notropis leuciodus*
	Highland shiner	*Notropis micropteryx*
	Silver shiner	*Notropis photogenis*
	Telescope shiner	*Notropis telescopus*
	Mimic shiner	*Notropis volucelus*
	Stargazing minnow	*Phenocobius uranops*
	Bullhead minnow	*Pimephales vigilax*
	Longnose dace	*Rhinichthys cataractae*
Fundulidae	Northern studfish	*Fundulus catenatus*
Ictaluridae	Black bullhead	*Ameiurus melas*
	Yellow bullhead	*Ameiurus natalis*
	Channel catfish	*Ictalurus punctatus*
	Mountain madtom	*Noturus eleutherus*

Ictaluridae	Flathead catfish	*Pylodictus olivaris*
Lepisosteidae	Longnose gar	*Lepisosteus osseus*
Percidae	Greenside darter	*Etheostoma blenniodes*
	Bluebreast darter	*Etheostoma camurum*
	Blueside darter	*Etheostoma jessiae*
	Stripetail darter	*Etheostoma kennocotti*
	Redline darter	*Etheostoma ruflineatum*
	Swannanoa darter	*Etheostoma swannanoa*
	Tennessee darter	*Etheostoma tennessense*
	Wounded darter	*Etheostoma vulneratum*
	Banded darter	*Etheostoma zonale*
	Tangerine darter	*Percina aurantiaca*
	Blotchside logperch	*Percina burtoni*
	Logperch	*Percina caprodes*
	Gilt darter	*Percina evides*
	Sickle darter	*Percina williamsi*
	Walleye	*Sander vitreum*
Petromyzontidae	Ohio lamprey	*Icthyomyzon bdellium*
	Mountain brook lamprey	*Icthyomyzon greeleyi*
	American brook lamprey	*Lampetra appendix*
Poeciliidae	Western mosquitofish	*Gambusia affinis*
Salmonidae	Rainbow trout	*Oncorhynchus mykiss*
Sciaenidae	Drum	*Aplodinotus grunniens*